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Electrical World

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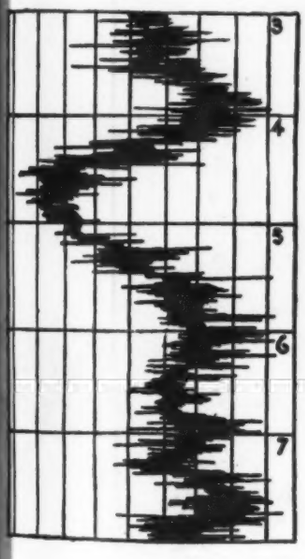

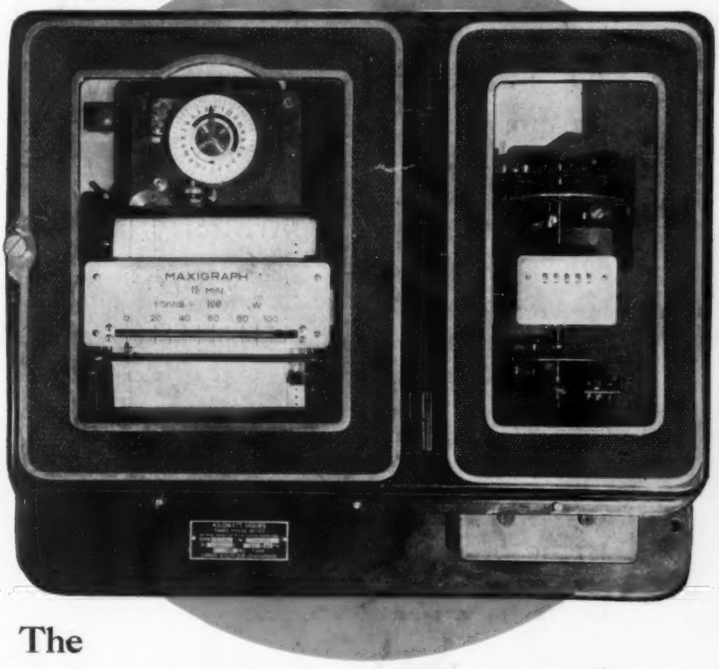

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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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If Municipal-Plant Salaries Are Taxed, Why Are Bonds Exempt?

THE decision of the Bureau of Internal Revenue assessing income taxes against employees of municipally owned water, gas, light and traction systems suggests a still wider application of the revenue laws. Inasmuch as the courts have decided that "the construction, operation or maintenance of water and gas plants by municipal corporations is not an exercise of governmental functions, but is rather in the nature of a private enterprise for the convenience, advantage or benefit of the municipality, its inhabitants and property owners," cannot the national government tax the earned income from municipal public utilities—an income accruing upon the bonds issued for such utilities? If a municipality establishes an electric light plant and thus owns and operates a private business, sometimes in competition with another electric light plant privately owned, should it be immune from the liabilities of a private corporation, and should the bonds issued for the purchase or erection of such a plant by a municipality be tax exempt? Having chosen to engage in such a business, ought not the municipality to observe the same rules required of a private corporation? In Massachusetts, for example, a municipal plant may not operate at a loss. Operating for private advantage and emolument, should not the bonds be on the same footing as those issued by a private corporation? The ruling of the Revenue Bureau, backed as it is by court decisions, would indicate so, and it might not be a bad idea to make a test case to determine whether or not many of the millions of tax exempt securities issued by states and municipalities are in reality entitled to exemption.

The Laborer Is Worthy of His Hire

GOVERNMENT statistics show that the average wage per wage earner is higher in the electric light and power industry than in other large industries. Yet the value of output per wage earner in the electric light and power industry is 25 per cent greater than in the textile industry, 20 per cent greater than in the iron and steel industry, 95 per cent greater than in the lumber industry, 20 per cent greater than in the paper and printing industry, 95 per cent greater than in the stone, clay and glass industry and 15 per cent greater than in the tobacco-manufacturing industry. Only in food and kindred products, chemical and allied products, metals and metal products, leather and its finished products and vehicles for land transportation is the value of output per wage earner greater than in the electric light and power industry; but in food it is 150 per cent greater and in chemicals 85 per cent greater.

A larger number of men and women in the electric light and power industry than in most other industries are employed whose work is clerical—for instance, reading meters, making out bills, selling appliances and service—rather than productive of electricity. When this fact is borne in mind, together with the low cost of the electricity, the comparison is quite flattering to the electric light and power industry. It serves to emphasize why this industry is singularly free from labor troubles and why it has made and is continuing to make such remarkable progress. The electric light and power industry does not employ much labor, but those it employs it pays well, and they in turn show by their efficiency and loyalty that they are worth what they get.

Supercopper

THE two great metals of the electric art, iron and copper, present many contrasts, but none perhaps more marked than that of the relative permanence and fixity of their respective properties. Electric steel presents a wide range of magnetic properties, and the more important of these properties have been steadily improved under study and experiment as the years have passed. Copper, on the other hand, shows little or no variation, is used for one property only over a wide field of application, and long years of acquaintance with it and attention to its refinement have resulted in improving its conductivity only a fraction of one per cent. In fact, copper has always been just copper, and the electrical engineer has been glad to feel that there is at least one tool of his trade not subject to continual change.

But apparently even copper has yielded to the restless probe of modern research, and now comes the really astounding announcement of copper with a conductivity 13 per cent greater than present standard values, and so greater than that of silver. The improvement is due to its crystalline state. The possibility of producing crystals of copper was first shown by Prof. Bridgeman of Harvard University, and the present announcement comes from Dr. W. P. Davey of the General Electric Company, who has succeeded in forming copper crystals six inches long by one inch in diameter, the method being slow heating and cooling in the electric furnace. It is not so remarkable that an increase in conductivity should have been found, the crystals once formed, for it is well known that many crystals have quite different properties in different directions through their structures. Many examples are found in optical phenomena, and dielectric properties show similar differences. So far the achievement is in the obtaining of the crystal rather than in the increased conductivity.

Crystal copper has several interesting properties. It can be bent without effort, but it cannot be straightened again. This is due to the fact that the distortion upsets the balance of the atoms, and they readjust them-

selves into the very small crystals of ordinary copper. The specimen passes over into the latter form and then shows all its properties. Dr. Davey showed by X-ray examination that his specimens are each one big crystal with the atoms arranged in regular rows, and that one of the axes of the cubic form in which copper crystallizes runs through the long axis of his single crystal six-inch rod. It was along this axis that the increased conductivity was found, and in order to show that the increase was due to the crystalline form, the specimen was hammered and then annealed so that its uniform structure was destroyed. Its conductivity was then found to be that of ordinary copper. Commercial copper was used for making the specimens.

The production of commercial copper of this increased conductivity would have consequences of far-reaching importance, as may readily be imagined. The reduction in cost alone would greatly increase the number of economically possible enterprises. Several press announcements have promised an early commercial production of the metal. In view of the present data, however, small credence can be given to these reports. All accounts indicate that crystal copper is extremely sensitive to working or handling of any kind, and this would seem to preclude its use in manufacture. But naturally we shall wait expectantly for the results of the further study and control of the properties of "supercopper."

New Laws for Old

PROOF that matter is discontinuous and that the scientific conception of continuity in nature is erroneous will be received with skepticism by those engineers and scientists who have not followed the recent work of scientists in the electronic field. Yet experiments of Millikan, Einstein, Lewis, Plank, Bohrer and others all lead toward this conclusion and indicate the validity of the quantum theory.

Thus, in the Lilliputian world of atoms, it is said everything is discontinuous and occurs by jumps as it were because of the shifting of electrons between energy levels. And the electromagnetic and electrostatic fields of Maxwell, the electrochemical theory of chemical reactions, the vibrational and wave theories of light are all questioned as to their real scientific accuracy in view of the proofs recently submitted in substantiation of the quantum theory of electronic behavior. The valence of matter, the periodic system, light, color. X-rays, the spectrum and many other phenomena have been explained or determined in a convincing manner by using the newer conceptions of energy, matter and electrons.

We are being led into a field of scientific and mathematical delving where infinitesimals must be used and the continuum theory of geometry and calculus must be displaced for lack of accuracy. Thus an electric field is a complicated and discontinuous mesh of infinitesimals and not a co-ordinate and continuous envelope. Fortunately, however, there seems no need yet for discarding the older laws of electricity, heat and mechanics in the workaday world of engineering, for, granted that they are only approximations of the truth, there remains much to be done before equally usable laws based on the newer conceptions can be applied to practical affairs.

Those who are working on the battle front of science should be encouraged to continue their experiments and their thinking, for who knows what new tools and useful agents may be discovered to enrich civilization or what practical improvements may be introduced into the present methods of using the treasure house of nature? History shows that most new things in science turn out to be useful things for mankind.

Capital Invested per Dollar of Output

IN ADDITION to the higher average wage per wage earner paid in the electric light and power industry, statistics on the capital invested per dollar of output reveal wherein the public utility business differs widely from other businesses. The census of 1922 shows that for every dollar of output in the electric light and power industry there was invested $4.48. This is an improvement over the figure shown in the 1917 census, where the capital invested per dollar of output was $5.80. However, when the figures are compared with the capital investments of other industries it is apparent why finance plays so important a part in the public utility business and why every safeguard must be thrown around the investment.

No other important business calls for such large capital outlays as the electric public utility business, and compared with it most businesses dwindle in this respect to unimportance. Thus, for example, the last census figures give the following capital investments per dollar of output: Food and kindred products, 37 cents; textiles and their products, 66 cents; iron and steel and their products, 93 cents; lumber and its manufactures, 84 cents; leather and its finished products, 60 cents; paper and printing, 81 cents; chemical and allied products, $1; stone, clay and glass products, $1.16; metal and metal products, 65 cents; tobacco manufactures, 60 cents; vehicles for land transportation, 60 cents. It will be seen that the investment per dollar of output is from four to twelve times greater in the electric light and power industry than in others, and that with the same rate of interest the fixed charges of the industry are from four to twelve times higher than in the average business enterprise. Of course, with wider interconnections and better load factors greater use is made of investment; but with the very best load factors obtainable the investment per dollar of output in the electric light and power business will still be much higher than in the average manufacturing plant.

Investigation Shows that the Eyes Are Used 70 per Cent of the Time

PRODUCTION increases in our offices and factories when the intensity of illumination is increased chiefly because the worker sees more quickly and with greater certainty than under lower intensities of illumination. There are other reasons of more or less importance, such as better morale, but these factors have not been subjected to as much investigation as those more directly associated with vision. In considering the possibilities of higher intensities of illumination in increasing production by influencing the speed and accuracy of vision the question naturally arises, What percentage of time does a worker actually use his eyes in doing his work?

This phase of everyday work is now being studied by a research laboratory devoted to the study of the

utilization of light. In twenty industrial and office processes which have been investigated the average portion of the time during which the eyes of the worker are engaged in close work has been found to be about 70 per cent. Obviously some processes require the use of the eyes very much of the time while others do not tax them so much. Nevertheless, it is interesting to know that the average is so great. These processes are found in ordinary offices, print shops, machine shops and electric lamp factories. In only six of the twenty processes did the percentage of time requiring close vision fall below 50 per cent. Only three fell below 40 per cent. Five were above 70 per cent.

This work indicates, as was to be expected, that increase in production due to an increase in intensity of illumination is likely to be different for various processes. But it does more, for it shows that close vision is required for a considerable percentage of the time in any of these representative processes. From these results it has been concluded by the investigators that the increases in production already noted in the few factory tests that have been conducted are conservative values and should be easily equaled in most cases and exceeded in many of them.

No Installation Standards Used in Transmission

FOR many reasons little standardization was expected to be found in transmission practices in the United States for lines operating at 44,000 volts or over, and the tabulation made in the supplement to the January 3 issue of the ELECTRICAL WORLD shows that little exists. But in some respects at least there is a greater lack of standardization than the situation warrants. Even in those sections where climatic, terrain and service conditions are very similar a great variation in practice occurs. This probably arose from the application of local ideas and incomplete principles to line installations for each property. Apparently all high-tension line engineering is local in character, and very few data can be produced to aid in reconciling the differences found in practice.

For example, the spacing of conductors on 66-kv. lines ranges from 48 inches to 123 inches; clearances to ground from 18 feet to 50 feet; clearances to highways, 29 feet to 50 feet; clearances to railroad tracks, 28 feet to 50 feet; clearances to telephone lines, 6 feet to 20 feet. For every voltage and for every feature of construction similar variations occur in spans, tensions, clearances and insulation values, and it is indeed difficult to explain them. Lines installed at the same time and in the same state exhibit these characteristics and so, at least in some cases, do different lines owned by one company. Thus the general conclusion is that almost anything will work and there exist no standards of practice.

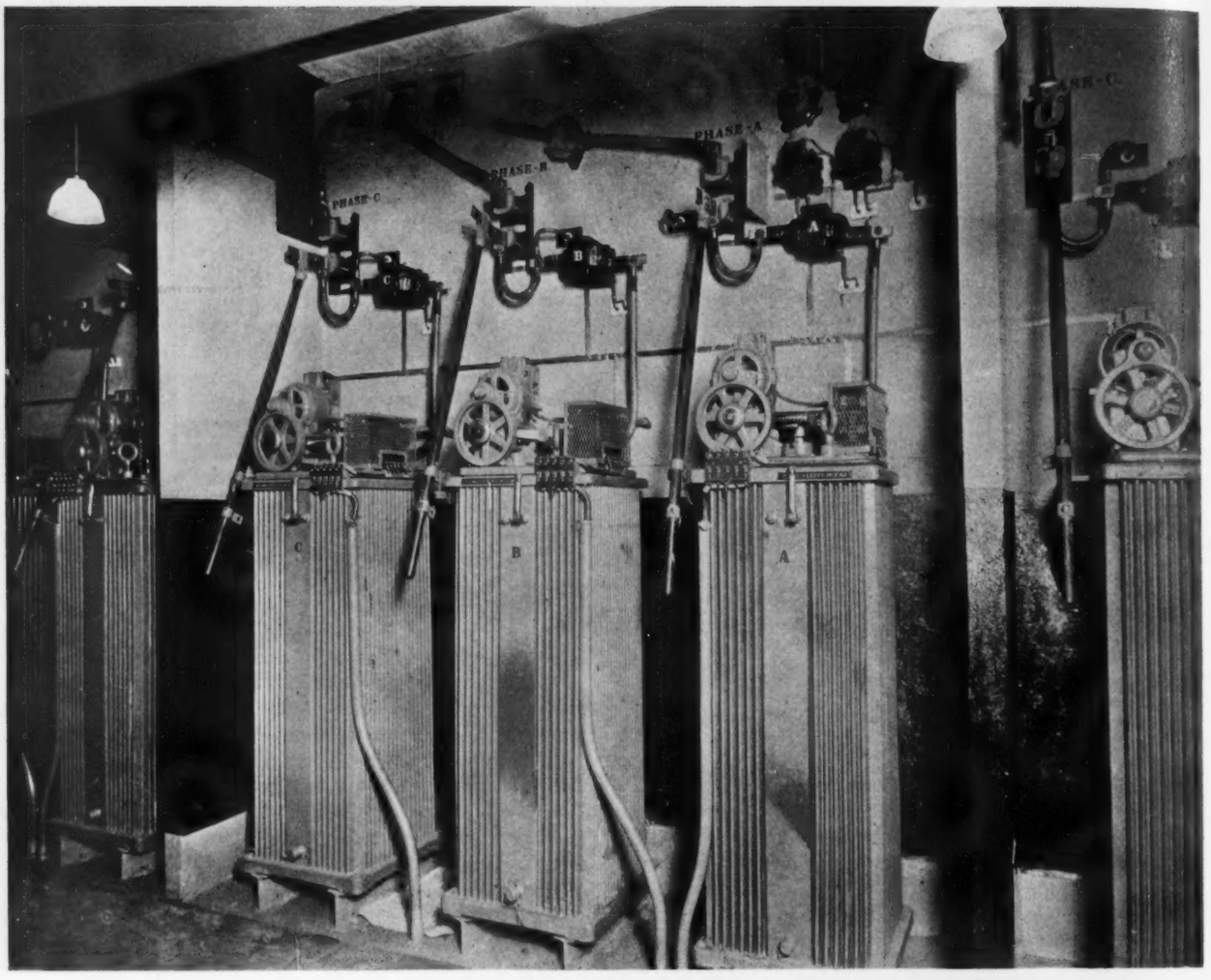
It is to be hoped that the Safety Code, industry committees and other aids to standardization will be invoked and used more freely in future installations, for surely more reason should be applied in the art of transmission and better agreement reached if installations are to be made on an economic basis. There is a big job before the transmission engineers, and it is apparent that to technical questions involving stability, insulation and transients must be added very pertinent ones dealing with mechanical details of installation.

Empirical Versus Rational Cures

A PRIMITIVE physician mixed the blood of a snake with an extract of tiger's claws and a frog's saliva in the hope of curing a disease (now known to be of bacterial nature), and in so doing he was impelled by the same fundamental motive as that which forces many a present-day engineer to adopt a hasty remedy at which the next generation will heartily laugh. This motive is the psychological necessity of meeting a practical situation at once, because of human discomfort or of commercial pressure, even though tomorrow the cure may be withdrawn as being worse than the disease. Physicians perhaps sinned in this respect more than engineers, but to the physicians also belong the honor of a new and rational attitude, at least in the treatment of parasitic diseases. Their present motto is: Never mind the patient, study the parasite. So we have brought into being numerous investigators who study various bacteria, insects and other carriers of disease, *per se*, as zoologists; who study life histories of such parasites and the conditions under which they thrive or cannot live. Then, when a remedy is announced, it is a rational cure, based on a positive knowledge of the parasite itself. It is sufficient to mention the control of yellow fever, of hookworm disease and of several plant maladies as a result of such a study. The most spectacular case is perhaps that of eradication of the so-called Katayama disease in Japan, which was caused by worms in the liver. A painstaking study of the life history of these worms has shown that one of their transformations must take place within a certain species of perfectly "harmless" snail which abound in stagnant waters in the affected localities. A study of the life history and the reactions of these snails showed that they cannot live in water containing lime. So, instead of drugging patients with complicated concoctions, lime was added to the water, and the disease was practically eradicated by the elimination of the intermediate host, the snail.

In electrical engineering there are problems of long standing akin to those that have baffled physicians—deterioration of insulation, surges and transients, low efficiency of illuminants, alternating-current commutation, opening of high-energy circuits, etc. Perhaps we do not add tiger's blood to the oil in high-tension switches to improve their operation, but we ignorantly do things which the future historian of our profession will probably mention only in an appendix entitled "curiosities of the twentieth century."

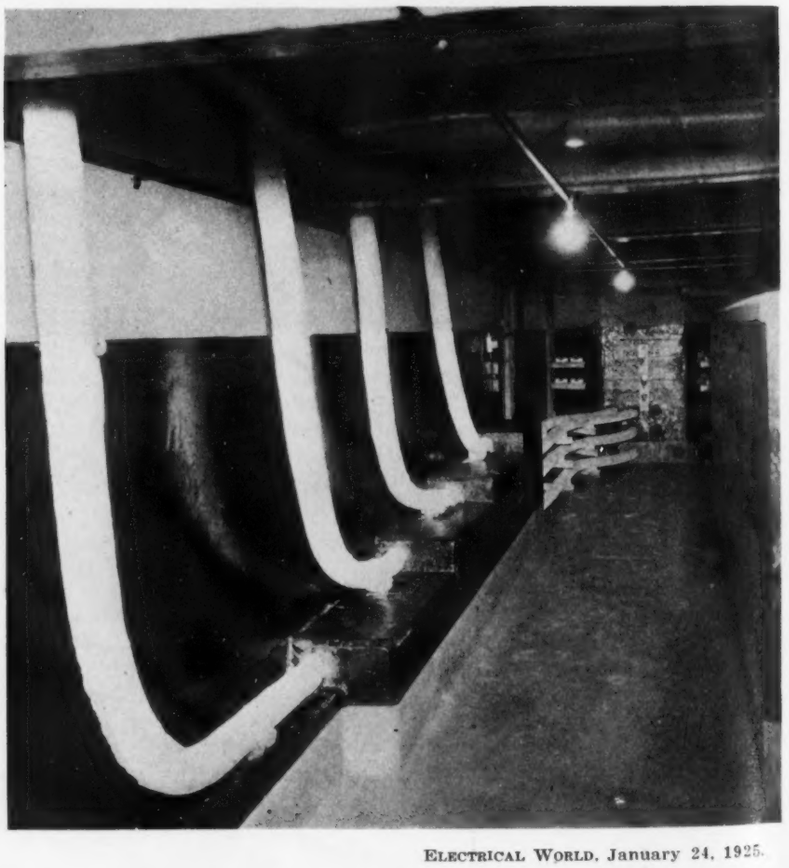
The rational tactics should be more physics and still more physics. Let us know what the nature of insulating materials is, what the intimate nature of an electric arc is, and let these problems be investigated by properly qualified workers interested in the physical aspects of the phenomena, without haste or desire to apply their findings to practical problems. Fortunately, this policy is being systematically adopted by large organizations in our own and in other industries, as well as by the scientific bureaus of our government. Many an enlightened manager of public or private affairs begins to see pure research in a new light. Those who hold the purse strings are becoming convinced that just as it takes time to develop sales in a territory or to make a trademark valuable, so it takes time and money to gain a thorough understanding of besetting difficulties of a physical nature.



New Substation for Pittsburgh

THE Duquesne Light Company has just completed the Grant Street substation. It is one of several large substations in contemplation for supplying energy to the downtown district of Pittsburgh.

The new substation incorporates several unusual design features. including compartment isolation of all equipment. The electrical features used to secure proper voltage regulation and the isolation of circuits in trouble are also new and the whole station is built to satisfy conditions in substations in the light of years of operating experience with the Duquesne system.

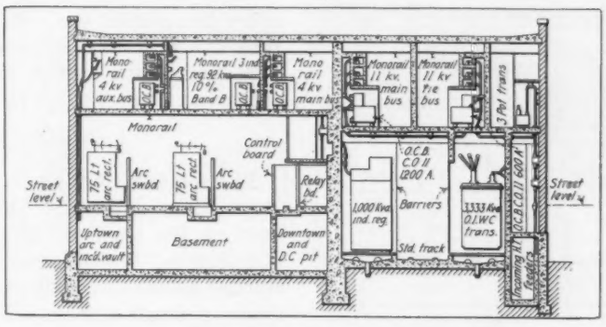


Pittsburgh's New Substation

Duquesne Light Company Completes 30,000-Kva. Structure for Metropolitan District of Western Pennsylvania City—Unusual Features in Design—Intended to Insure High Degree of Safety and Reliability

By G. SUTHERLAND* and H. S. MOORE†
Duquesne Light Company, Pittsburgh, Pa.

IN RECENT years the growth of the central-station load in the downtown district of Pittsburgh has been extremely rapid, both in magnitude and importance. This has been due to the fact that virtually all of the large hotels, theaters, department stores, newspaper plants, telephone exchanges and telegraph stations have changed to the central-station system. Because of this growth and of the anticipated increase in load, the Duquesne Light Company has undertaken in the downtown triangle a complete reconstruction of its distribution system, involving the construction of three new substations whereby duplicate 4,000-volt feeders will run to each customer's vault.



CROSS-SECTION OF GRANT SUBSTATION
A feature of the design is the use of completely inclosed concrete compartments to isolate equipment.

The first unit of the new system to be completed is the Grant substation, on the southeast corner of the triangle. The ultimate capacity of this station will be 30,000 kva. The initial installation is for 20,000 kva., consisting of eight 11,000-volt transmission feeders, three 10,000-kva. transformer banks, eight 4,000-volt, three-phase feeders to serve the downtown triangle and five 4,000-volt, three-phase feeders to supply the uptown section. One transformer bank is held as a spare and is not included in the capacity rating of the station.

Grant substation is a two-story red-brick building having a 72-ft. frontage and a depth of 107 ft. A railroad siding passes the rear of the building. Physical separation of different sections of the electrical system is emphasized throughout the station.

The first floor is devoted to operation. The operating room contains the remote-control alternating-current switchboard, the direct-current switchboard, a 1,000-kw. rotary converter, street-lighting rectifiers and constant-current transformers. The transformer room is also on the first floor and contains three banks, each consisting of three 3,333-kva., single-phase water-cooled transformers with one 1,000-kva., three-phase bus regulator for each bank.

The second floor is devoted to switching and is divided into six longitudinal compartments separated by concrete walls. These compartments contain 11,000-volt potential transformers on each incoming cable, 11,000-volt line and transformer oil switches, bus reactances, 4,000-volt line and bank oil switches and regulators on the uptown feeders. The rear section of this floor is an open balcony which is accessible to a crane and the monorails which run the length of each compartment. A workbench is installed on the balcony for the use of maintenance men, and has outlets for portable drill presses, soldering irons and other appliances.

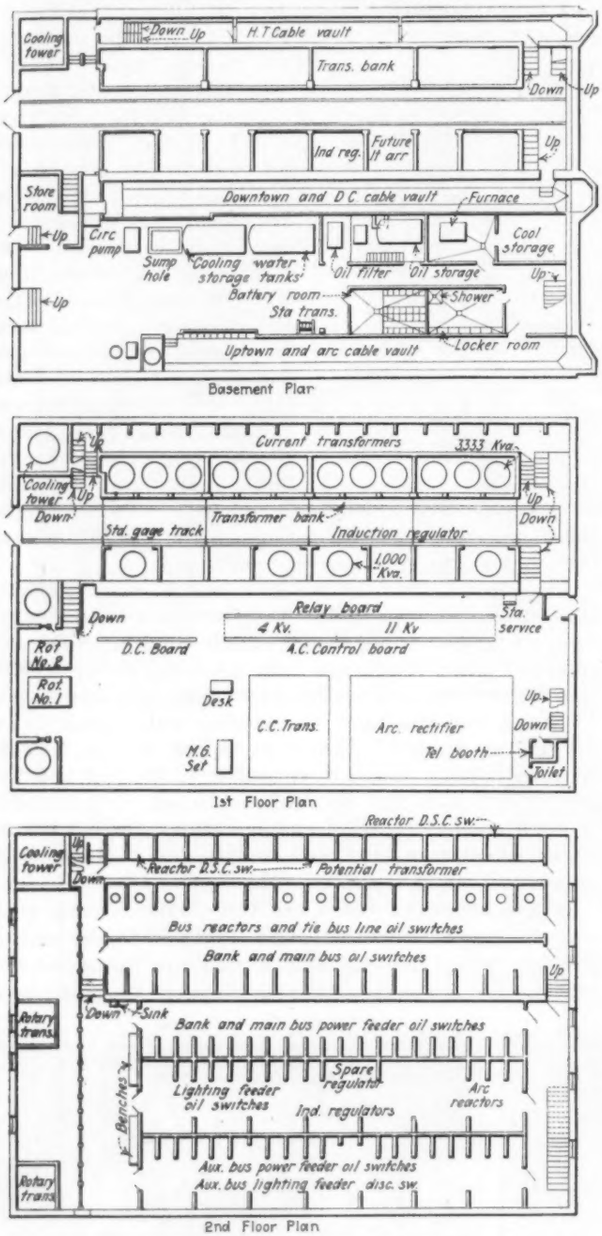
In the basement there are three cable vaults, each one of which extends tne entire length of the basement, one for the 11,000-volt cables, one for the 4,000-volt cables and one for the street-lighting and direct-current

*Electrical engineer. †Substation operator instructor.

FRONT AND REAR VIEWS OF SWITCHBOARD

cables. Each vault is connected to manholes at both ends, providing six independent exits from the station. An operator's locker room equipped with a shower bath, a storeroom for maintenance material, the heating plant and auxiliary equipment, consisting of water-cooled tanks and circulating pumps, air compressor, storage batteries, oil filtering and storage equipment, are also installed in the basement.

The general layout of the main circuits of the station is shown in the single-line diagram on page 191. Extremely flexible switching arrangements are provided on both high-tension and low-tension sides. The fundamental source of supply consists of six 11,000-volt cables direct from Brunot Island, each of 6,000-kva. maximum capacity, two feeding into each transformer bus through 600-amp. truck-type oil switches. Auxiliary supply is provided by the cables from adjacent stations, so laid out as to form a part of a 22,000-volt inner ring, feeding into auxiliary bus sections which are connected to the main or transformer buses through 2.5 per cent reactors and 1,200-amp. truck-type oil circuit breakers. Normally all switches will be closed so that Brunot Island and ring lines will operate in parallel. If, however, special conditions make it desirable, the reactor breaker may be opened and the entire capacity of the ring cables diverted to adjacent stations. The reactors perform the double function of limiting short-circuit currents to values for which cheaper oil switches can be obtained and assisting in proper load distribution when lines are in parallel.



FLOOR PLAN OF GRANT SUBSTATION

Longitudinal walls divide each floor into isolated compartments.

Each main bus section with its corresponding auxiliary bus section and tie switch forms a unit which may feed one or two transformer banks, but paralleling of two such units, except momentarily during switching operation, is prevented by an electrical interlock.

BUS REGULATOR USED

The solution of the voltage regulation problem at this station is of interest. The decision to carry power and light on the same feeders established the necessity for a system of low inherent impedance in order to limit voltage fluctuation to 2 per cent on lighting installations under normal operation. Individual feeder regulators with reactors sufficiently large to protect the regulators were out of the question because of the high reactances which they would introduce into circuits supplying large motors. Since the feeders in the district are short and approximately of the same length and rating, bus regulation offers a very satisfactory solution. A 10 per cent buck-or-boost three-phase, 1,000-kva. water-cooled regulator is connected between each transformer bank and its 4,000-volt bus section.

On the 4,000-volt side each transformer bank is connected to two bus sections and the oil switches are interlocked as on the high-tension bus so as to prevent tying two sections together. This arrangement greatly reduces the interrupting duties of the oil circuit breaker, prevents paralleling of the bus regulators and provides additional flexibility of operation by permitting different voltages on the various bus sections when desired.

As the uptown or Hill district is largely fed by overhead lines with feeding points quite remote from the substation, individual feeder regulation becomes desirable and at the same time permissible since there are no large motors on these circuits. For this service five feeders are equipped with individual feeder regulators.

The 4,000-volt equipment is placed in three compartments, the transformer and power-feeder main-bus oil switches in the first, main-bus lighting-feeder oil circuit breakers and regulators in the second, and auxiliary-bus power-feeder oil switches and auxiliary-bus disconnecting switches for the lighting feeders in the third. All the power or downtown feeder breakers are single-solenoid-operated, while the lighting feeder, station service and street-lighting switches are three-solenoid-operated oil circuit breakers.

A spare regulator circuit is provided, so arranged that it may be paralleled with any other lighting feeder regulator on the auxiliary bus and the regulator removed without an outage on the feeder.

Truck-type oil circuit breakers are used throughout the station. The 11,000-volt type CO-11 breakers have an interrupting capacity of approximately 400,000 kva., and the 4,000-volt B-13 oil switches an interrupting capacity of 110,000 kva. Truck-type breakers were adopted for this station after a careful investigation, which indicated the following advantages:

1. Very material simplification of the layout of circuits.
2. Elimination of disconnecting switches.
3. Material increase in the operating safety of the station and facility of maintenance.
4. Gain of advantages enumerated above with no increase in cost.

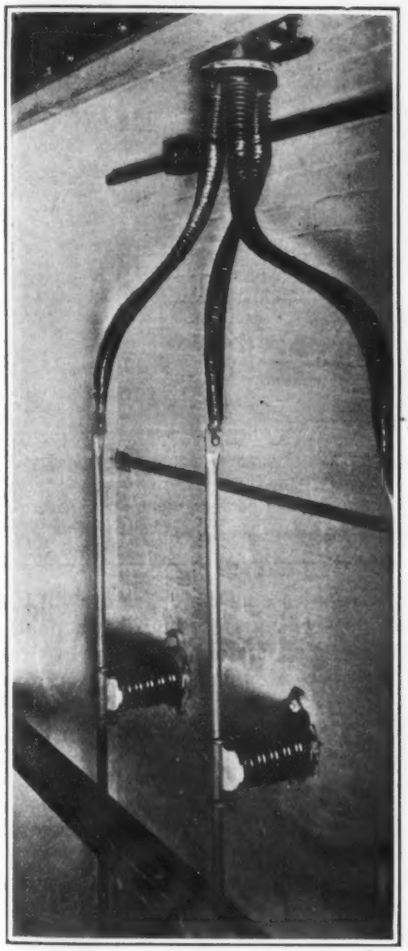
Adequate safety features are provided. The most important one is a mechanical interlock which prevents a truck being moved until the oil switch is open and locks it out when clearing a circuit from the bus, thus eliminating the danger of accidental closing. Shutters are provided which automatically close over the bus and line terminals when the truck is removed from its compartment. In addition to these safeguards, a special interlock is provided on circuits with feeder regulators so that the disconnecting switches on the circuit or regulator cannot be opened while the circuit breaker is closed.

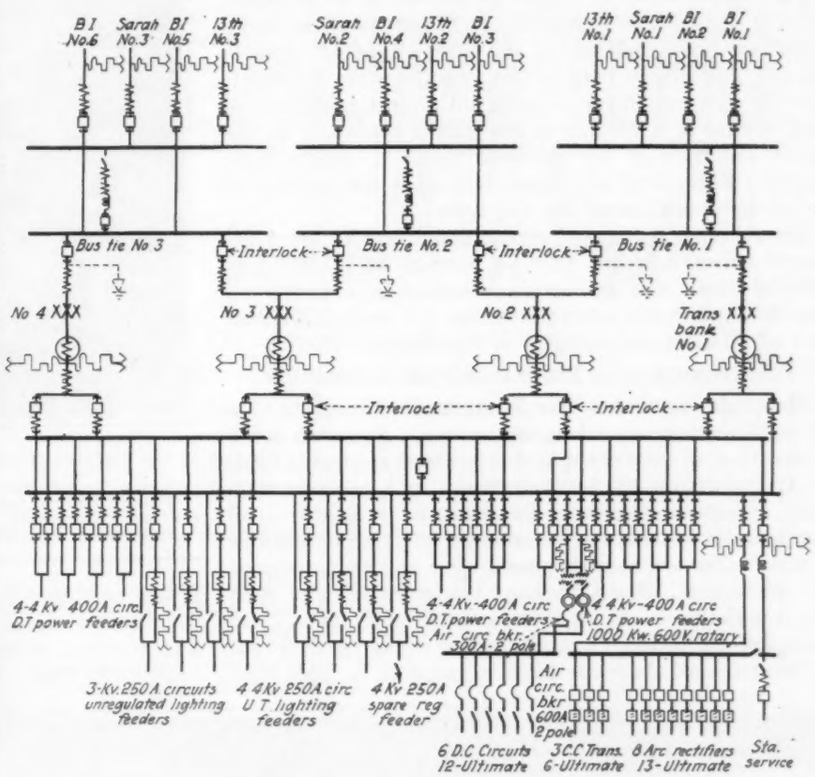
The switchboard is divided into two parts as shown in an accompanying view. All controllers, with the dummy bus, pilot lamps and meters, are placed on the front panel, and all of the relays and regulator compensators are placed on the rear panel. This eliminates the massed wiring that would be needed on a one-panel board and also facilitates the testing and tracing of control circuits. The switchboard pilot-lamp lenses are hemispherical, making the lights clearly visible from both the sides and front.

A bell alarm and colored lamp placed above the switchboard warn the operator when an oil switch opens. Different signals are provided for the 11,000-volt and the 4,000-volt systems. These signals are in addition to the regular red and green lamps on the switchboard, indicating the exact switch positions. Each relay is equipped with an indicating drop showing which relay operated on a breaker opening. This system has been a great help in the study of relay functioning and the correction of faulty relay operation. Three potential transformers are installed on the line side of all 11,000-volt feeder switches to feed live-line-indicating lamps on the switchboard and to provide potential for directional line relays.

Type CZ impedance relays are installed on the high-tension incoming cables. These relays are equipped with wattmeter elements and supply directional short-circuit protection to the lines. The timing feature of these relays is automatic. This is inherent in the construction of the relay and is secured by means of a driving element actuated by current which is opposed by a voltage element connected to the line. Since the potential on this coil is directly proportional to the distance between the relay and the fault it is obvious that the time of operation of the relay is also proportional to this distance. This eliminates the necessity of applying definite time settings to the relays and is a decided advantage in the care of complicated networks.

Ground protection on the high-tension cables is secured by means of type CW watt relays. This relay has its current coil connected in the common, sometimes called residual, circuit of the line current transformers, and its potential coil is connected inside the delta of a three-phase star delta potential transformer. When a phase becomes grounded this supplies a potential to the





ABOVE—ONE-LINE DIAGRAM OF CIRCUIT ARRANGEMENTS FOR GRANT SUBSTATION

AT LEFT—A GROUND BUS AND A 110-VOLT SOURCE OF SUPPLY RUN THE LENGTH OF THE ELEVEN-CABLE VAULT TO PROVIDE TESTING AND GROUNDING FACILITIES

CW relay which is in phase with the ground current and gives very positive relay action. A timing overload relay is connected in series with the CW relay to permit selective time setting to be made.

Each of the three high-tension bus sections has differential relay protection. Trouble on the bus or in any of the incoming line oil switches on that section will clear all the line oil breakers connected to that bus. A similar scheme is used on each transformer bank so that trouble in the bank will clear both its high-tension and low-tension breakers. A low-energy ground relay is also used in the high-tension bus differential scheme.

The 4,000-volt feeders are protected by straight overload, and the CW relays are omitted because a ground failure will operate the overload relay.

The station-service feeder is protected by overload and CQ phase-balance relays. It is fed from the same 4,000-volt bus from which the street-lighting circuits are fed, and this in turn is tied into the main 4,000-volt bus through two three-solenoid oil circuit breakers, so that in case of a failure on one phase a portion of the street lamps may be operated from a single-phase supply. Failure of one phase will open the service oil switch by operation of the CQ relay.

For relaying purposes current transformers are overlapped throughout, so that no portion of a circuit is omitted from the protective scheme, thus providing selective automatic relay protection for each individual part of all electrical circuits in the station.

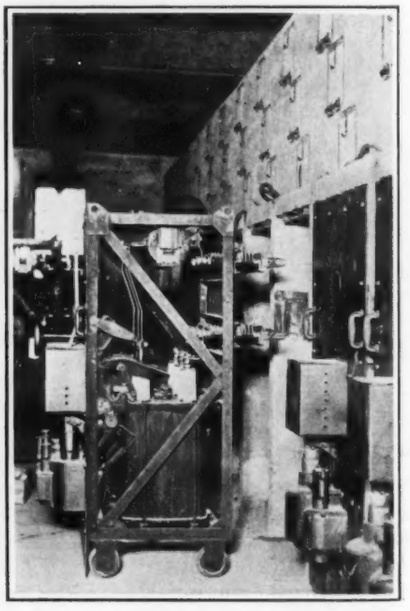
TRANSFORMER AND REGULATOR FIRE PROTECTION

Elaborate provision has been made for protection against transformer and regulator fires. As shown in the illustration, all control apparatus has been separated from the transformers and bus regulators by a concrete wall. This apparatus includes temperature indicators, oil gages, water valves, alarms and special pipe connections to the "foamite" nozzles placed over the transformers and regulators. Each bank of transformers and each bus regulator is in a compartment by itself, and these are protected from the other units by fireproof walls and steel doors. While a bank is in operation it will be closed in on all sides and the operator will be required to make his observations through a peephole and need not go into the compartment. In case of fire "foamite" from either of two portable supply trucks

ALL CONTROL APPARATUS IS SEPARATED FROM EQUIPMENT BY A FIRE WALL

View of control installation for one compartment of transformers and regulators, showing peephole, temperature indicators, control valves and facilities for fighting fires.

SECOND FLOOR OF GRANT SUBSTATION, SHOWING THE OPEN BALCONY EQUIPPED WITH A CRANE



A 4,000-VOLT TRUCK-TYPE OIL BREAKER

The crane shown at the left is accessible to the monorails running longitudinally the length of each compartment. This installation proved advantageous during the construction of the station and facilitates repair and maintenance work.

can be safely applied through the special pipe in the fireproof wall back of the transformer or regulator. In addition several carbon-tetrachloride air-pressure and hand-pump extinguishers are available throughout the station.

A complete closed-circuit water-cooling system for transformers and bus regulators has been installed, including a cooling tower, circulating pumps and storage tanks. Losses from the water-circulating system are supplied from city mains, but the station can run for several weeks without external water supply if necessary.

All non-conducting metallic parts and one side of all control circuits are connected to a heavy ground bus, substantially grounded through plates buried under the station.

A ground bus and a 110-volt source of supply run the length of the 11,000-volt cable vault to provide for grounding of cables when desirable for maintenance and for phasing out after repairs. This equipment is shown in an accompanying illustration.

Strips of linoleum tested for 20,000 volts are placed on all floors where normal operation is performed, and in addition a portable rubber mat tested for 40,000 volts is kept on each floor for use where linoleum has not been installed. Doors with panic latches are installed at each end of all compartments. Gas masks, effective in all gases including carbon-monoxide, are installed in convenient locations about the station. Street-lighting recording ammeters subjected to high voltage are inclosed in glass cases which are locked when the street-lighting circuits are energized. Emergency lights at strategic points throughout the station are connected to an independent circuit normally fed from the station bus, but automatically transferred to the control battery if power on the bus fails.

Special care was taken in designing the cable vaults to make all cables readily accessible. The high-tension vault is shown in an accompanying illustration. The cables run on racks from the manhole to wall ducts, where with a wide bend they pass up to the pothead on the floor above. The exposed portions of cable are covered with a non-conducting fireproofing, which prevents trouble on one cable spreading to another.

California Power Shortage of 1924

Drought Experienced by Power Companies Last Year Was the Worst in Forty Years — How Situation Was Met to Produce Least Inconvenience and Loss to Consumers

By H. G. BUTLER
Consulting Engineer, San Francisco

WHEN the power companies of southern California found in the late spring of this year that a curtailment in the use of electrical energy was imperative on account of a serious water shortage, they, with the Railroad Commission, turned to H. G. Butler, a consulting engineer of San Francisco, to act as power supervisor. Mr. Butler was chosen largely because of the skill he displayed in similar executive work during wartime conservation. In the work just drawn to a close he occupied a buffer position between the utilities, the consumers and the public. He performed the task of satisfying all three and of bringing about teamwork and co-operation during a critical period in a most able manner.

THE season of 1923-24 will long be remembered in California as a year of unusual drought. In both precipitation and stream run-off low marks were established in records extending over a period of forty years. Coming as this season did after a series of seven dry years, conditions were particularly trying all over the state, but the southern portion was exceptionally hard hit. Los Angeles normally has a seasonal rainfall of 15.25 in., most of which comes in the five months beginning November and ending in March. In 1924 up until the first of March the total seasonal rainfall of Los Angeles had been but 1.8 in. to compare with a normal of 11.08 in. In March the normal was somewhat exceeded, but the season ended on June 30 with a record of 6.67 in. The situation in the mountains to the west and north of Los Angeles which furnish it with hydro-electric energy was relatively the same. At Huntington Lake, the principal storage reservoir of the Southern California Edison Company, the precipitation, with the exception of one year, was little more than half of the lowest in a period of fourteen years (Table I).

These records do not, however, tell the whole story. The snows came late, rested on dry ground and were evaporated by the first warm winds of the spring without causing the average proportion of run-off.

As is usual, the deficiency in precipitation worked a double hardship on the hydro-electric power companies. They had heavy demands for agricultural pumping, and the lack of rain in the fall and early winter made it necessary for the ranchers and farmers late in the winter and early in the spring to substitute irrigation water lifted from the lowered water tables that had received very little replenishment since the last irrigation season. The output of the Southern California Edison Company in January, February and March was 25 per cent greater than for the same months the year before and most of this increase was due to irrigation pumping.

POWER SHORTAGE FACED

Early in June it became apparent that this company would be unable to meet the demands of its existing consumers and continue to take on new business. The Bureau of Power and Light of the city of Los Angeles was no better off, and of the two neighboring hydro-electric companies one was almost certain to be short in the fall and the other could not get through without unusually good luck. Under these circumstances the

Railroad Commission was appealed to, and it appointed a Power Supervisor to whom was given jurisdiction over all of the power companies and power interests from the San Joaquin Valley south to the Mexican border.

In order that the situation may be understood, it is necessary to explain first the physical layout and the geographical relationship of one company with another. The large power load of the city of Los Angeles is served by the Los Angeles Gas & Electric Corporation and by the Bureau of Power and Light of Los Angeles, a municipal system, in competition with the utility.

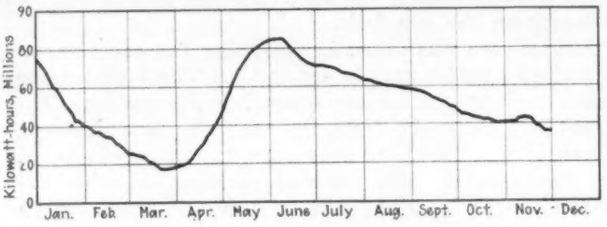


FIG. 1—STORAGE IN HUNTINGTON LAKE RESERVOIR WAS USED AS A BAROMETER TO CHECK POWER SHORTAGE AS SITUATION PROGRESSED

The Los Angeles Gas & Electric Corporation generates its energy entirely by steam, while the Bureau of Power and Light obtains its energy in part from hydro-electric plants along the Los Angeles aqueduct and in part by purchase from the Southern California Edison Company, under a contract entered into between the city and the power company when the distribution lines of the city were purchased a few years ago from the Edison company.

The Edison company itself serves on all sides of Los Angeles, southerly as far as San Juan Capistrano, easterly to Riverside and San Bernardino, northerly along the coast to Santa Barbara and in the San Joaquin Valley to Tulare and Hanford. Joining the Edison company on the north are the lines of the San Joaquin Light & Power Corporation, which extend as far north as Modesto and west to the Pacific Ocean. The San Joaquin company generates its energy partly from natural-gas steam plants and partly from hydro-electric plants in the mountains east of Fresno.

To the east of the Edison company's system is the Southern Sierras Power Company, whose main source of energy is in the Owens Valley near the source of supply of the Los Angeles Aqueduct, and whose main load is in San Bernardino, Riverside and vicinity and on the long transmission lines extending from these cities to the Imperial Valley and the Mexican line. The San Diego Consolidated Gas & Electric Company serves San Diego and the adjacent territory, and its energy comes entirely from steam.

This group of companies is all interconnected. The Edison company and the Bureau of Power and Light are connected at Los Angeles so the entire load of the Bureau of Power and Light can be carried directly by the Edison company, as both operate at 50 cycles. The rest of the group operate at 60 cycles and are connected with the Edison company through frequency changers or by the operation of 60-cycle units at 50 cycles. The interchange capacity of the Edison company with the Los Angeles Gas & Electric Corporation is 30,000 kw., with the Southern Sierras company 5,000 kw., and 5,000 kw. with the San Diego company.

When the office of Power Supervisor began work the situation was this: The Southern California Edison Company, by far the largest of the southern group, with a daily load of 4,750,000 kw.-hr. was operating its steam plants to their highest capacity, was either using or arranging to use the small steam plants of private consumers in its territory, and was purchasing all the energy the Los Angeles Gas & Electric Corporation had available and all that could be secured from the San Diego company. With all its resources an estimate of its load conditions showed that it would fall from 20 to 25 per cent short of meeting its demands from July 1 to December 1.

The Bureau of Power and Light, selling about 1,130,000 kw.-hr. a day, was generating 62 per cent from its own hydro-electric plants and purchasing the rest from the Edison company. As a consumer of the Edison company it was short from that source, and its own hydro-electric supply was proportionately as bad as the Edison company's. The resources of the San Joaquin Light & Power Corporation would with the least bad luck in its steam production be inadequate, and this company might in any event fall short of its requirements, particularly since it had a contract to deliver 12,500 kw. of continuous energy to the Edison company, which took effect the first of August.

The Southern Sierras Power Company was short using its own resources alone. It had, however, a contract with the San Diego Consolidated Gas & Electric Company to purchase more than 5,000,000 kw.-hr. a month, and an interconnection between the two was being pushed with all speed across the range of mountains which lies between San Diego and the Imperial Valley. With this additional energy it was estimated it could about carry its own load without bad luck until the spring of 1925, when it would be short and would require help in turn.

To the north the San Joaquin Light & Power Corporation is connected with the Pacific Gas & Electric Company at Manteca. The interconnection, however, will not transmit more than 6,000 kw. from one company to the other, and the Pacific Gas & Electric Company and the other companies in the northern portion of the state were by no means certain they would escape without a shortage themselves. They were, like the southern companies, purchasing from the private plants that could be pressed into service and as a consequence were unable to assist the southern group to any appreciable extent.

TABLE I—YEARLY PRECIPITATION AT HUNTINGTON LAKE

Year	Inches	Year	Inches
1910-11	57.67	1917-18	25.33
1911-12	32.15	1918-19	28.72
1912-13	18.61	1919-20	29.61
1913-14	35.81	1920-21	28.93
1914-15	31.93	1921-22	34.53
1915-16	43.35	1922-23	26.88
1916-17	27.61	1923-24	14.43

Later on in the summer a small northern plant which was then idle—that of the city of Alameda—was started up for the benefit of the Southern California Edison Company, and the interconnection was used. The energy from the Alameda plant was passed through the lines of the Great Western Power Company to the Pacific Gas & Electric Company, from the Pacific Gas & Electric Company to the San Joaquin Light & Power Corporation, and from the San Joaquin Light & Power Corporation through the frequency changer to the

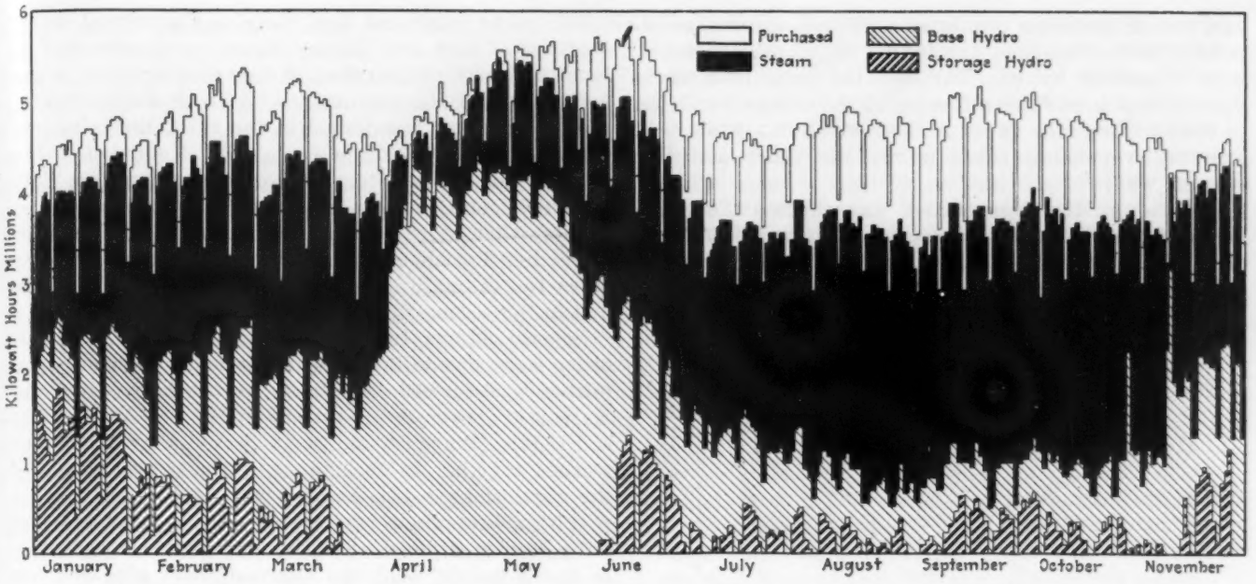


FIG. 2—SYSTEM LOAD CURVE OF SOUTHERN CALIFORNIA EDISON COMPANY, SHOWING PURCHASED POWER, STEAM POWER, BASE HYDRO AND STORAGE HYDRO

Edison company. A kilowatt-hour which made the full journey to Los Angeles traveled about 500 miles.

At the start the shortage was concentrated upon the Edison company and the Bureau of Power and Light. The Edison company was obtaining energy from five general sources (1) its own steam, (2) that of the small industrial plants it had leased or rented (shown as steam in Fig. 2, which also shows the use of other resources for 1924 to November 30), (3) purchases from the Los Angeles Consolidated Gas & Electric Company and the San Diego company, (4) its base hydro—that is, the energy from unregulated stream-flow plants —and (5) stored water. As the use of stored water furnished the only element of elasticity, the rate of the withdrawal of this water furnished a test by which it could be determined at what rate the company could carry through the season. The mass curve of the potential energy in storage on the Edison system (see Fig. 1) made a concise and accurate picture of the entire shortage situation, especially late in the year when the Edison was purchasing from all of the neighboring companies.

The main reservoir of the Edison company is Huntington Lake, which controls 193,500 kw. in generating capacity in the power houses below it. The lake when full holds 86,000 acre-feet of water, one acre-foot being equivalent to 4,000 kw-hr. This year when the mass curve of the water in Huntington commenced to point downward, there were 21,000 acre-feet in the lake, and as it was necessary to carry 7,000 acre-feet over the first of January, 1925, only 14,000 acre-feet remained for use during the summer and fall of 1924. Late in June the curve for the lake indicated that it would be exhausted by August 15.

SUPERVISOR'S ORGANIZATION

The Power Supervision office was organized on July 1, with a Power Supervisor and assistant and a manager of publicity, and had offices with the branch office of the Railroad Commission in Los Angeles. A "power committee" was immediately formed, having in its membership an operating official from each of the power companies and the Bureau of Power and Light. This committee met weekly throughout the duration of the short-

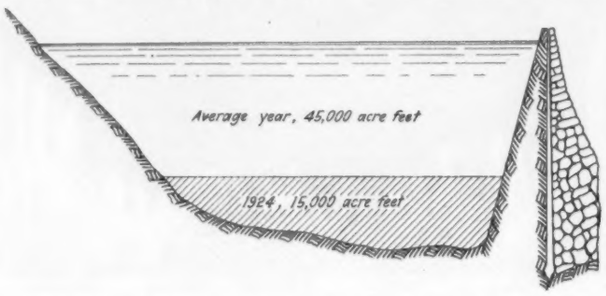
HUNTINGTON LAKE DURING THE DROUGHT LAST YEAR IN SOUTHERN CALIFORNIA

At the left is shown the bed of Huntington Lake, which is usually 20 ft. to 30 ft. under water, as it looked during the recent power shortage in southern California.

At the right, the wall in the distance that confines the waters of Huntington Lake. The principal storage reservoir of the Southern California Edison Company is more than 60 ft. in height. This picture carries its own vivid story of the startling depletion of stored water for hydro-electric power during the past season.

age, and all problems connected with the interchange of power, restrictions and the taking on of new business were discussed by it. Through the committee each interest was kept fully informed of the energy available in the territory, the effect of the restrictions, what new business was being taken on by the other and the reasons why.

Just before the organization was effected the engineers of the Railroad Commission, who had been handling the situation, in view of the alarming rate at



WATER STORAGE CONDITIONS ON THE SAN JOAQUIN SYSTEM

which the Huntington Reservoir was being depleted, very properly authorized the Edison company to reduce its load immediately, and the company set out to secure a 25 per cent reduction. To each district a quota was given based on its previous consumption, and the district managers in turn allotted to their industrial, commercial and agricultural consumers a proportion of the energy their districts were to be allowed to use. A force of meter readers was put to work to check the allotments to consumers. The Bureau of Power and Light followed the same procedure.

In the order which created the office of Power Supervisor the Railroad Commission prohibited the taking on of any new business unless the consent of the office had first been obtained. As it would have caused an unnecessary hardship to refuse to serve dwellings and small motors which were ready for service, one of the first orders of the Supervisor covered this subject.

New business could be taken on at the option of the companies to a maximum of 3 hp. for power consumers, and for lighting applications those which could be served by the installation of a meter and service connection and did not exceed 2 kw. Heating and cooking loads were not accepted. Every application for new power which exceeded these amounts had to run the gantlet of, first, the local officials of the power companies; second, the operating representative of the power company on the power committee, and, third, the power committee as a whole.

LIGHTING RESTRICTIONS

The main difficulty in connection with restrictions was found with lighting. The Los Angeles Gas & Electric Company and the Bureau of Power and Light of the city are in competition in Los Angeles, as has been said. The power company with its steam equipment had sufficient energy not only to care for its own load but to make large deliveries to the Edison company, while the Bureau of Power and Light was short and was making every effort to reduce its consumption 25 per cent. The consumers of the power company in the city were fully aware of this condition, and many of its lighting consumers refused to put out their sign and display lights.

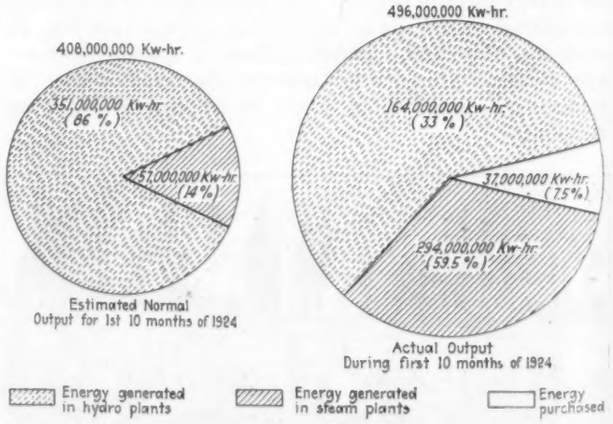
It was realized from the start that the general public could not be convinced that there was a critical power shortage if sign and display lights were permitted to burn, and with two services in the same territory it was necessary that the consumers of both should be treated alike. An order was issued to the effect that sign and display lighting should be completely eliminated in Los Angeles and the territory served by the Southern California Edison Company, except on Saturday and Sunday nights; that store window and interior lighting and street lighting should be sufficient only in the first two cases for the safe conduct of the consumer's business and in the second for public safety.

Several efforts to insure the carrying out of this order were unavailing, and in the end a lighting committee was formed, on which were employees of the Bureau of Power and Light and of the Los Angeles Gas & Electric Company, and one representative from each worked together in securing a uniform observance of the regulations in Los Angeles with fairly good success.

With a few minor modifications the restrictions that have been mentioned—that is, a 25 per cent reduction in the industrial load, the elimination of sign and display lighting and those regarding new business—were carried on through the season. The last of these regulations applied to all companies in the territory except the San Diego company, which had excess capacity over its own load and its interconnections with other companies. The second applied to the Southern California Edison Company, the Bureau of Power and Light and the Los Angeles Gas & Electric Company. The first affected only the Southern California Edison Company and the Bureau of Power and Light.

As the season developed, the resources were found somewhat greater than the estimates and the load somewhat less, so both the San Joaquin Light & Power Corporation and the Southern Sierras Power Company escaped curtailments to their consumers, although both, by voluntary work in their territories, conserved considerable stored water by shifting load to off-peak hours.

At all times during the summer there was energy


408,000,000 Kw-hr.
351,000,000 Kw-hr (86 %)
57,000,000 Kw-hr (14 %)
Estimated Normal Output for 1st 10 months of 1924
496,000,000 Kw-hr.
164,000,000 Kw-hr (33 %)
37,000,000 Kw-hr (7.5 %)
294,000,000 Kw-hr (59.5 %)
Actual Output During first 10 months of 1924
Energy generated in hydro plants
Energy generated in steam plants
Energy purchased

TYPICAL CONDITIONS ENCOUNTERED ON THE SAN JOAQUIN SYSTEM

available without the use of stored water between 10 p.m. and 6 a.m. A considerable load on the Edison company and the Bureau of Power and Light was changed from earlier hours, where it was carried by storage, to the "graveyard shift," and new business was permitted to come on if it could and would use energy at that time. Existing consumers also who were caught by the restrictions were permitted to exceed

their quotas if the extra energy was taken between 10 p.m. and 6 a.m.

This shifting of load had the effect of lightening the burdensomeness of the restrictions. Some of the larger consumers who could do so, as the cement plants and oil companies, installed gas, Diesel and steam engines to make up the energy shortage caused by the allotments, and in other cases the allotments for an entire industry in a section were combined and the energy used in the most efficient plants under plans worked out by the consumers.

The two electric railways—Pacific Electric and the Los Angeles Railway—both of which are large consumers of power, carried out comprehensive programs for the use of skip stops, an increase in headway and the elimination of service on unimportant lines. These changes were put into effect gradually without seriously impairing the railway service.

No trouble was experienced in reaching the farmers because of the existence of the California Federation of Farm Bureaus. The director of the utility department of that organization had from the start kept himself fully apprised of the power situation, and when it became apparent that a shortage of energy was not to be escaped he organized in each county a power committee, with which the district managers of the power company worked in requiring the reduction in agriculture. So in effect the farmers and ranchers, while meeting the reduction requirements, used their own judgment as to which particular crops and sections could best bear the burden.

No priority list was established. Some preference was nevertheless shown. Public health and safety, of course, came first. No power was curtailed to an existing or refused to a prospective consumer if he would suffer a capital loss without it. The main burden of the restrictions fell, first, on those who would merely be inconvenienced by them and, second, on consumers, prospective or existing, whose loss would be a temporary one of return on investment by decreased output, or, if the curtailment was made up by a gas engine or other power, by increased expense.

On November 9 a heavy general rain over the entire State of California, which followed a few lighter rains earlier in the season, caused the irrigation load to drop off and the stream-flow plants and reservoirs to pick up. This ended the shortage and all restrictions were removed.

ANOTHER SHORTAGE UNLIKELY

There is hardly a chance of another shortage in the immediate future. On the first of December the Edison company put in service the first of two new 35,000-kw. units in its Long Beach steam plant, and the second will follow early in 1925. The Florence Lake tunnel, which will make available for Huntington Lake from another watershed sufficient water to have filled the lake even during the year of drought, will be completed early next summer, and the Los Angeles Gas & Electric Corporation will have available in July the first 30,000-kw. unit of a new steam plant. It is worthy of note that even with restrictions the power companies in the territory affected finished 1924 with a 10 per cent increase in energy sales over last year.

It is impossible to estimate even approximately the cost of the power shortage to southern California. The damage done, however, was relatively very small, and this damage was partly offset by many changes which grew out of the curtailment of electrical energy and will continue long after the shortage has been forgotten. The railways benefited by the installation of the "skip stops" and the elimination of some services in outlying territories; the farmers in very many cases found that the restrictions which limited their use of water were of positive benefit, and the general conservation program which resulted from the restrictions taught many consumers that their use of electricity had been wasteful and that the same results could be obtained with a smaller expenditure for energy.

That a situation which in June threatened to be serious almost to the extent of a disaster worked out so well is due almost entirely to the spirit which pervaded the whole southern portion of the state and made full and hearty co-operation possible. The chambers of commerce, the governments of Los Angeles and the neighboring cities and those in the San Joaquin Valley, the theater owners and operators, the merchants, and twenty other associations, the California Federation of Farm Bureaus, which has already been mentioned—all of these and most of the individual consumers uncomplainingly gave up their personal advantages for the good of the community. But, of course, the power companies, including the Bureau of Power and Light, were called upon to make the heaviest sacrifices, and it is a sufficient commentary on what they did to say that they forgot for the time their financial and competitive positions to see that the people of southern California got all the energy that could be made available and the best service that was possible under the very trying operating conditions.

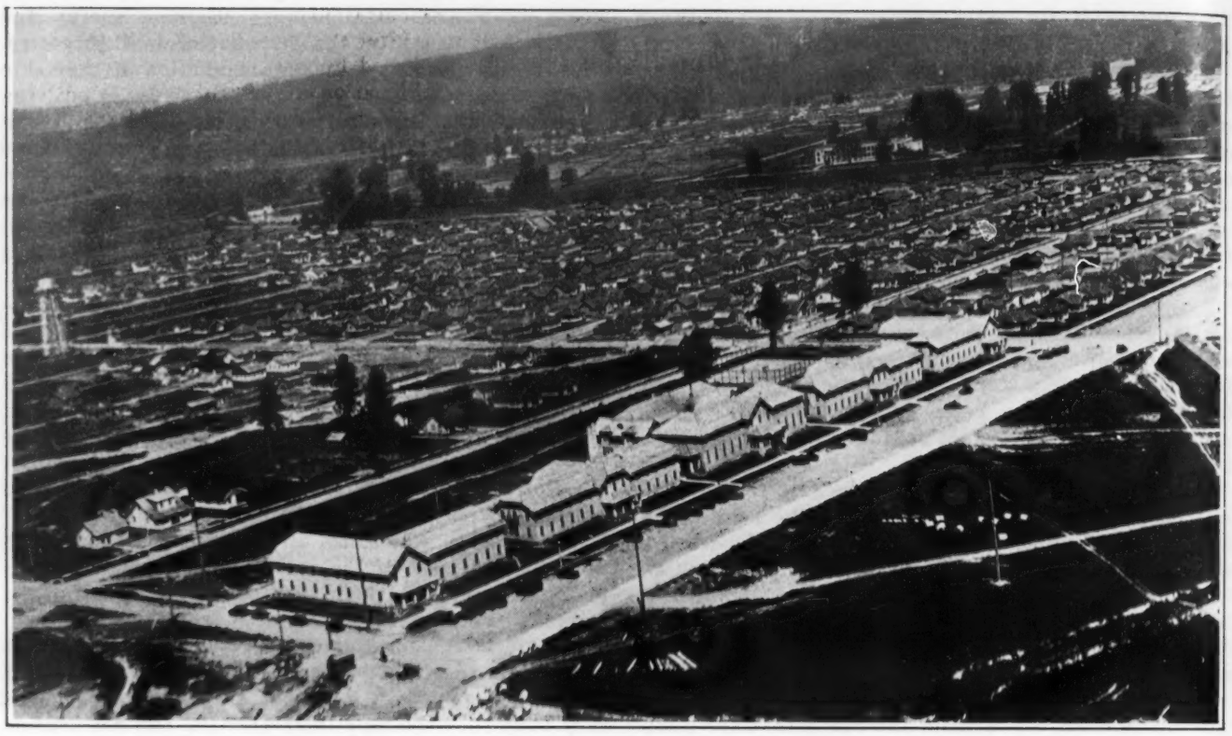
Progress in Electric Brass Melting

DATA recently issued by the Bureau of Mines show that the United States is leading the world in the electric brass-melting field. In this country there are about 275 induction-type furnaces, 135 moving indirect-arc furnaces, eighty Baily furnaces (granular resistor type) and fifty furnaces of various other types, making a total of some 540 electric furnaces used for melting non-ferrous metals.

On January 1, 1922, there were installed or being installed 399 active furnaces used for melting brass and bronze. These were distributed by types as follows: 177 induction furnaces, 100 moving indirect-arc furnaces, eighty-three Baily furnaces and thirty-nine furnaces of other types. These figures show that in about a year and a half approximately 140 electric brass-melting furnaces have been installed. This increase indicates that the growth will probably continue and that it is only a question of time before virtually all non-ferrous metals will be melted electrically.

The pronounced increase in the number of induction and moving indirect-arc furnaces has been due to the fact that they are both very efficient, give comparatively low metal loss and thoroughly mix the metal, thereby producing excellent metallurgical results at a low cost.

The induction type of furnace is particularly suitable for twenty-four-hour operation in rolling mills on yellow brass. The moving-arc type is being used particularly for red brass and general foundry work where the operation involves a nine-hour day. These two types of furnaces will probably continue to have the applications indicated unless a more satisfactory lining is found for use in the induction furnace for melting red brass.



AIR VIEW OF PART OF THE NEW LUMBER CITY OF LONGVIEW, WASH.
This modern city of 10,000 population stands where two years ago there were only fields and swamps.

Many remarkable and new applications of electricity to modern lumber operations are illustrated in the Longview project. More than 18,000 kw. is distributed through underground services in the first unit of the installation

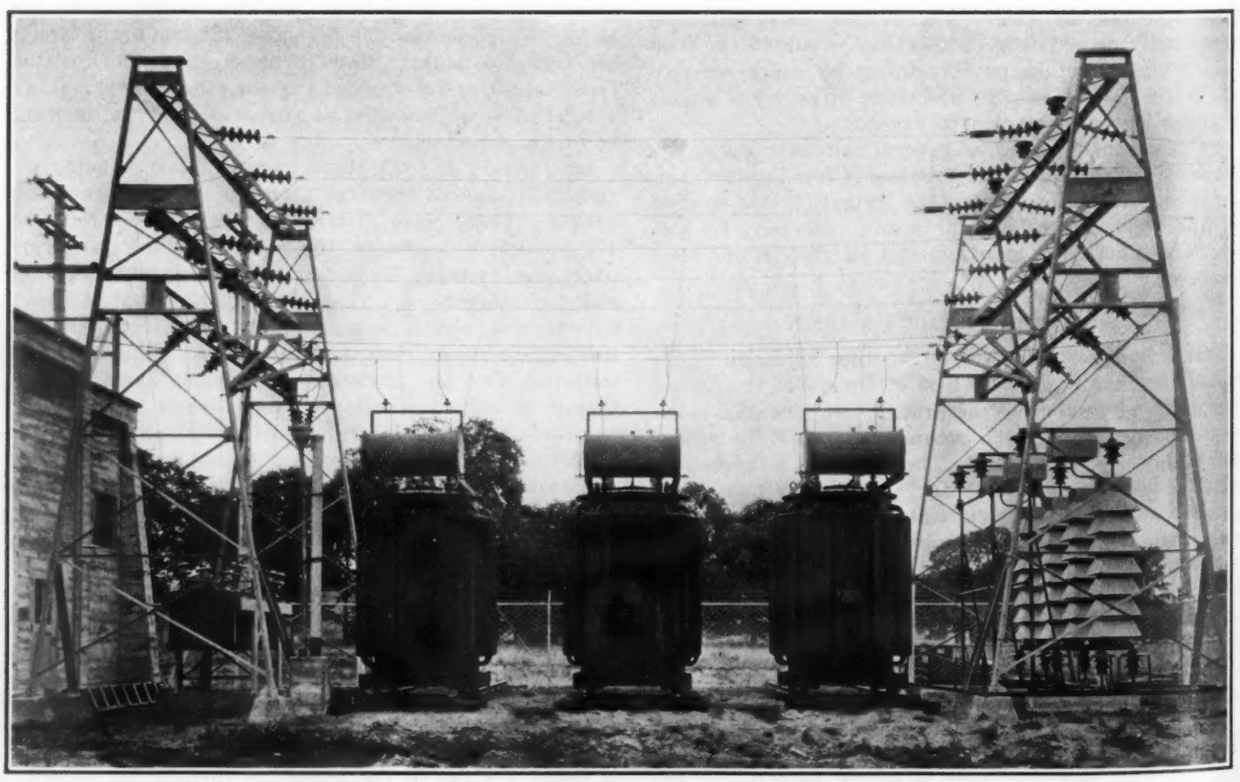


FIG. 1—OUTDOOR SECTION OF MAIN SUBSTATION SHOWING TYPE OF BUS CONSTRUCTION USED

Electricity in a Modern Lumber Project

II—Primary Distribution and Substations

Design of System to Distribute 18,000 Kw. to Large Industrial Project—All Circuits Are Placed Underground—Outdoor Substation Has Interesting Features

By FRANK R. INNES
Sessions Engineering Company, Chicago, Ill.

THE production of finished lumber in all commercial forms from the dripping log that comes up the log haul from the pond requires a plant, which, by the nature of its processes and the necessity of isolation of buildings for fire protection, must cover a large area. The total mill-site area at Longview is 1,737 acres. Of this large plot the major part is, of course, taken up by ponds, storage yards, docks and other handling spaces, but the space devoted to manufacturing operations is not insignificant. From this it follows that the distances between concentrations of load are so great as to make a low-voltage system of electrical distribution very uneconomical. The obvious thing to do is to use a high-potential distribution system with substations at places of high load density.

In the present west side mill unit there are three points at which power demands are concentrated. These, as shown in Fig. 3, are in the neighborhood of the head mill and manufacturing plant, where the logs are cut up into lumber; near the dry kilns, which require a large block of power for the operation of air circulation fans, and at the planer mill, where the lumber is finished into commercial forms. At these three points there are installed, in the order named, the "West Fir" substation, the "West Kiln" substation and the "West Planer" substation (see Fig. 3). In addition to the load on the mill site the power house serves two other demands. These are the load caused by operations in the woods—covered in the preceding article of this series—and the town of Longview. To care for these there is a fourth substation just north of the mill area. This is designated as the "main" substation. A schematic wiring diagram of the power house, substations and distribution system for the west side mill unit is shown in Fig. 2.

In order to avoid the unsightliness and, not infrequently, actual danger of heavy overhead wires in industrial areas, all of the primary distribution is underground. In the ultimate mill layout the duct-line system will follow the general shape of a horseshoe with the power house at the curve. At present only the west side of the horseshoe is installed. In this there are twenty manholes, identified by even numbers from two to forty and at standard spacings of 300 ft. The duct structures are of 4-in. Orangeburg fiber conduit set in concrete on 6½-in. centers. The concrete envelope

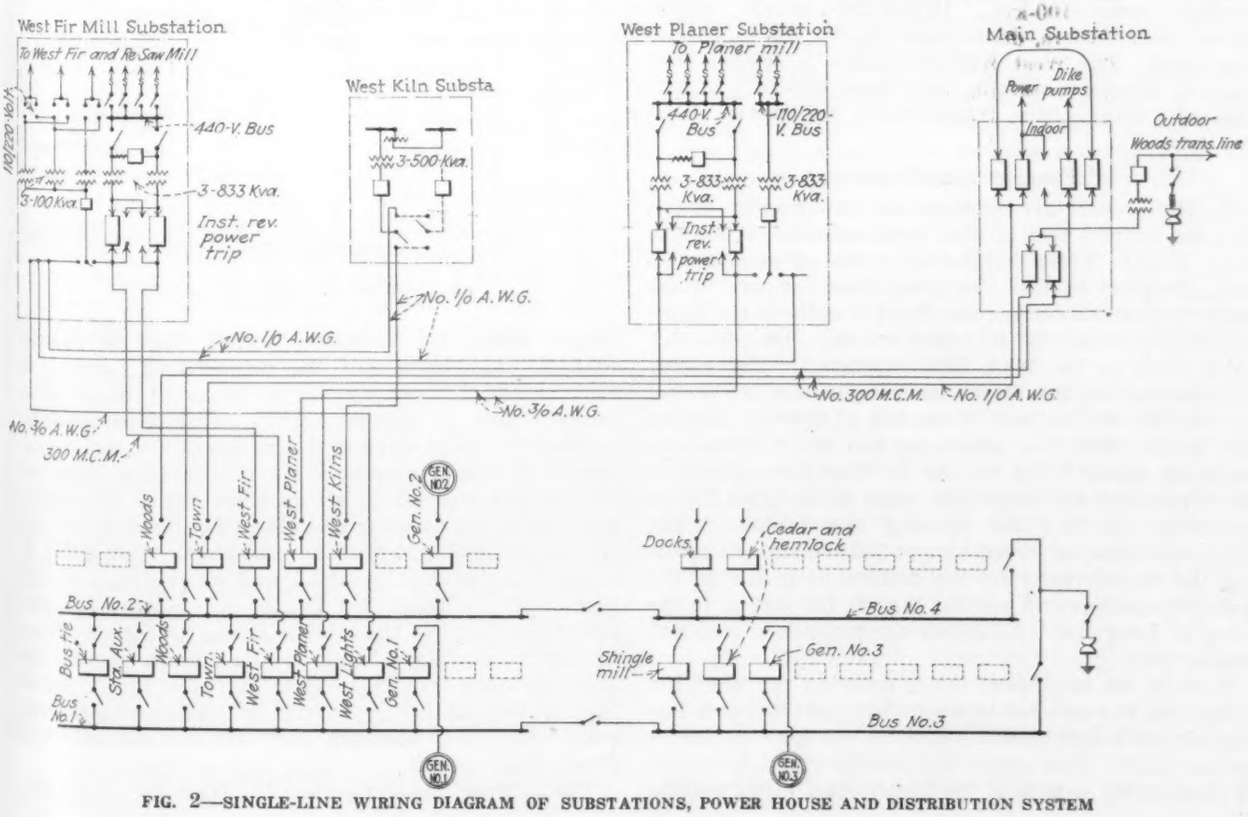


FIG. 2—SINGLE-LINE WIRING DIAGRAM OF SUBSTATIONS, POWER HOUSE AND DISTRIBUTION SYSTEM

around the duct stacks is 3 in. thick and 6 in. on bottom. The line starts out from the power house with thirty ducts in two stacks and tapers down to nine ducts in a single stack at the main substation, the end of the run. The top of the duct stacks averages 3 ft. under the surface of the ground. The standard manholes are of concrete, of oval shape, 6 ft. x 8 ft. and 6 ft. head room, and have 30-in. covers.

From preliminary studies of the installation the following determinations of substation load were made:

Substation	Connected Load, Kw.	Demand Factor	Maximum Thirty-Minute Demand, Kw.	Power Factor
West Fir	5,638	0.70	4,377	0.77
West Kiln	991	0.77	862	0.90
West Planer	3,122	0.68	2,469	0.88
Main—Woods load	3,220	0.66	2,673	0.60
Main—City load	2,990	0.37	1,500	0.90

These figures dictated the capacities of substation equipment.

Although the above table shows a considerable difference between the estimated loads on the West Fir and West Planer substations, the two were designed and built to be identical with each other, and similar equipment was installed in them. The reason for this is that load in the planer mill is expected to be considerably increased by the addition of machinery for the production of boxes, shipping cases and other miscellaneous items to use up short lengths of finished lumber that would otherwise have no more than fuel value.

In each of these two substations are installed six 833-kva., 13,200/460-volt, single-phase transformers connected in two closed-delta banks. Each bank is served by a separate cable from the power house, and the two banks are connected through 3,000-amp. double-break hand-operated safety switches to a common 460-volt bus, from which feeders are taken off to load centers in the mill buildings. In addition to the power transformers, the Fir and Planer Mill substations each contain three 100-kva., 13,200/220-110-volt, single-phase transformers, delta-connected, for the mill lighting loads. The West Kiln substation is smaller than the two others, containing only three 500-kva., 13,200/460-volt, single-phase transformers for power delta-connected.

FEEEDER ARRANGEMENT

In the present arrangement the power-house bus is in four sections tied in with sectionalizing switches to form a ring. From this bus are taken off two 300,000-circ.mil cables to feed the power transformers in the West Fir substation and one No. 3/0 cable to the lighting transformers in the same station. One No. 1/0 cable feeds to the West Kiln substation. The power transformers in the West Planer substation are served by two No. 3/0 cables. From the 13,200-volt lighting bus in the West Fir substation two No. 0 cables are taken off, one of which runs to the West Kiln substation for throw-over service and the other to the West Planer substation to feed the lighting transformers. The main substation is served by two 300,000-circ.mil cables for the transformers on the transmission line to the woods operations and one No. 0 cable for service to the town of Longview. All cables are paper-insulated and lead-covered.

Each of the two power cables entering the West Fir substation is connected to a separate bus. On each bus are two truck-type switch positions, one for each transformer bank. Two trucks are provided, and by means of these either or both of the transformer banks may be connected to one or the other of the incoming lines. The common secondary bus fed by both transformer banks introduced a condition not altogether desirable, but it was disposed of in a rather ingenious manner. The opening of one of the truck oil switches would take the load off the bank of transformers to which it was connected, but the bank would remain excited through the secondary from the common bus. In order to avoid breaking the magnetizing current with one of the knife-blade secondary switches, an oil breaker is connected between them on the hot sides. With this

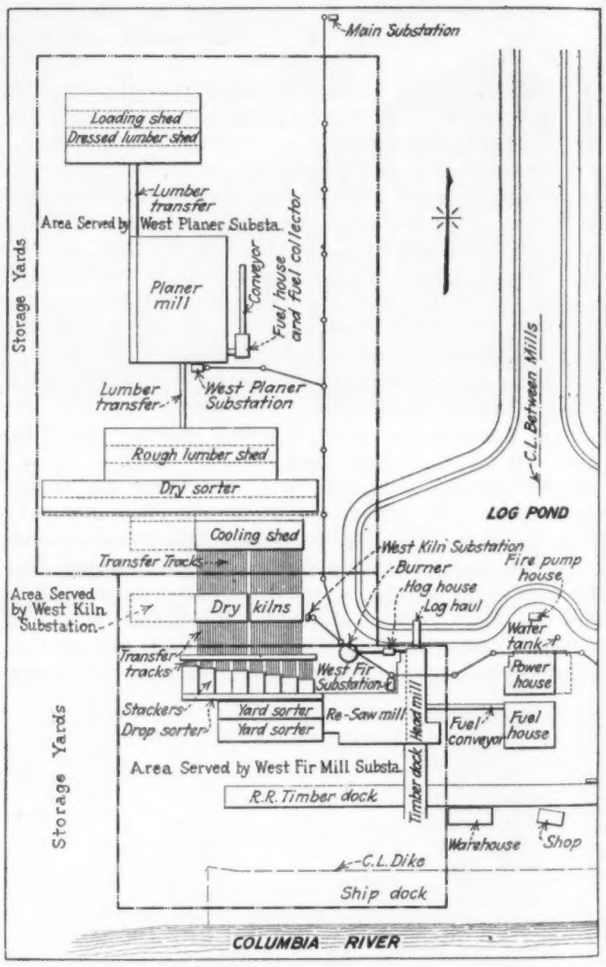


FIG. 3—PLAN OF WEST SIDE MILL

switch closed, the secondary switch may be opened without any arcing and the magnetizing current is then broken by opening the oil breaker. Since it is intended that all of the mill-site substations shall be unattended except when switching operations are necessary, a system of automatic lamp signals was installed so that the position of all switches would be readily apparent to the entering operator. The breakers on the trucks are equipped with reverse-power trips only, it being intended that overload and short-circuit conditions shall be cared for by the oil switches at the power-house end of the cables. Owing to the reactance of the transformers being in the circuit, should the truck switches trip on reversal of power due to cable failure, the rupturing capacity of these switches will not be exceeded, although they are non-automatic to direct short circuit.

The lighting transformers in the West Fir substation

are fed normally from the separate No. 3/0 cable earlier referred to. The transformer primary connections are made to this cable through a non-automatic oil switch and a double-throw disconnecting switch. The second position of the disconnecting switch permits the imposition of the lighting load onto one of the power cables as a throw-over resource.

The West Planer substation is identical with the West Fir substation, and the foregoing description applies to both. The West Kiln substation contains no truck-type switches. Primary connections are made through a non-automatic oil breaker and a double-throw disconnecting switch to permit service from either of the two entering lines. A second arrangement identical with this is provided for the reception of additional transformers and cables in the future. The lighting load on this station is very small and is cared for by a 5-kva., 440/220-110-volt transformer on the secondary bus.

The two 300,000-circ.mil cables that run to the main substation are intended to serve the logging operations transmission line. They are connected through truck-type switches to the primary of the bank of three 2,000-kva., 13,200/66,000-volt transformers referred to in the previous article. The high-tension side of these transformers is connected to the line through an oil breaker equipped with inverse-time-limit trip. The line is protected at this point by a set of oxide-film lightning arresters. The present load on the woods transmission line is only a small part of what it will finally be, and it can easily be carried on one of the two cables from the power house. The other is used as a reserve, and during its use as such it serves as a supply to the town service. The town service now consists of two power lines and a town encircling loop for general service. One power line and one end of the loop are connected to the reserve woods cable through a temporary jumper, and the other power line and the other end of the loop feed from the No. 0 cable from the power house. A truck-switch position between the two power lines provides means to serve all the town load from one cable if necessary. When the woods load has increased to such a value that it requires both cables, a second No. 0 line will be run in for the city service and the two loads will be entirely distinct.

The design of the outdoor section of the main substation is novel. Instead of supporting the buses on a continuous rigid structure over the transformers, they are suspended between two separate A-frames at each end of the transformer bank, as shown in Fig. 1. The frames are set on center lines spaced 48 ft. apart. They

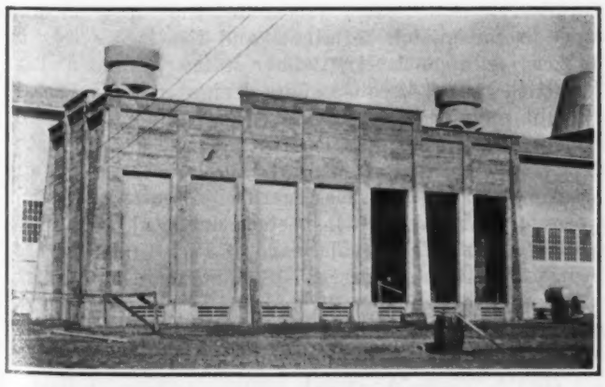


FIG. 4—WEST PLANER SUBSTATION, TYPICAL OF CONCRETE CONSTRUCTION USED ON MILL SITE

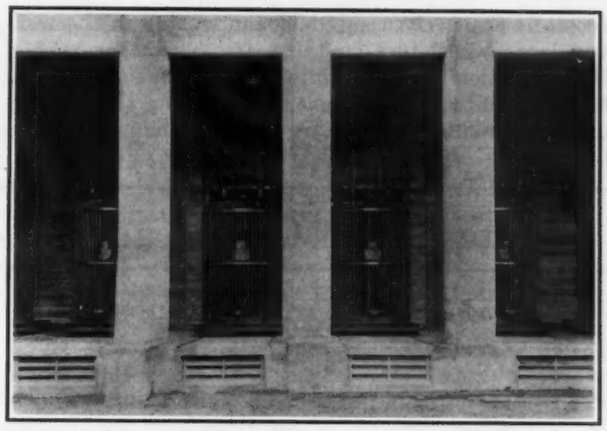


FIG. 5—WEST FIR SUBSTATION, SHOWING TWO BANKS OF SIX 833-KVA. TRANSFORMERS AND VENTILATING LOUVERS

are 32 ft. high, 24 ft. long and have a leg spread of 12 ft. The legs are anchored on concrete piers. The buses are hung on strain insulators in three levels, the lowest one, 18 ft. from the ground, being the 13,200-volt primary; the next, 25 ft. high, the 66,000-volt delta bus, and the top, 31 ft., the high-tension line bus. Between the legs of the A-frame next the substation building is the line oil breaker with the leads dropping to it from the middle delta bus and the top line bus. The cable riser and pothead for the 13,200-volt feed are at this end of the bank. Below the second A-frame is the oxide-film lightning arrester, tapped onto the line as it takes off from the frame to the first pole of the transmission line.

When the railway from the timber to the mill is electrified, another outdoor section duplicating the present one will be added to the main substation. The building will be extended to provide room for additional switching equipment and a motor-generator or rotary converter. The present underground duct line from the power house has sufficient capacity for the additional cables that will be required.

In addition to the alternating-current equipment in the mill-site substations, each contains a direct-current switchboard of the same design as the 440-volt secondary boards, for distribution of services to cranes and monorails. The direct current is distributed from two 300-kw. motor-generators in the power house through two single-conductor, 1,000,000-circ.mil cables in the ducts, from which are taken off 500,000-circ.mil branches to the substations. The generating pressure of the direct current is 275 volts, which is calculated to maintain 235 volts at the substation switchboards under full-load conditions.

All substations are of reinforced-concrete construction, as shown in Fig. 4. The mill-site substations are each divided into three rooms. The transformer room, which occupies about half of the building, is isolated from the rest by a concrete wall with a single doorway fitted with a sliding metal fireproof door. This door is connected to a set of weights through a trigger operated by a sprinkler fuse so that in case of fire the door will automatically close. The outside wall of the transformer room has rolling metal doors, 15 ft. high, at each transformer. The transformer-room floor is 3 ft. above grade. The transformers are mounted on rails on the floor, and under them is a pit communicating by means of seven air ducts, each 1½ ft. x 4 ft., with louvers in the outside wall near the ground line, as shown in Fig. 5. Air circulation in the transformer

rooms is positively assured by the louvers in the walls and large ventilators on the roof. The other part of the substation is divided into two floors. On the upper is the high-tension equipment and below are the secondary switchboards. There are no windows in these buildings.

Letters from Our Readers

Economics of Power-Factor Correction

To the Editor of the ELECTRICAL WORLD:

Let me explain some of the points Alex Dow writes about in his letter in the issue of January 10. The first one is the cost per kva. of generator capacity. In my article in the ELECTRICAL WORLD, issue of December 13, about the middle of the last paragraph in the first column on page 1248, is the statement: "If a new station is considered, the cost of the corrective equipment plus its switching and control apparatus must be balanced against the *increment* cost of larger turbo-alternators plus a percentage of this cost to account for the larger boilers, buildings, etc." Mr. Dow's figure of $6 per kva. is very good for this increment cost.

Now, suppose we have an old system, with the power factor well below the rating of the generators. Thus the output is limited by the heating of the generators and the turbines cannot develop their full capacity. By installing synchronous condensers at $12 per kva. we can release turbine capacity costing $100 per kva. If the condensers are not installed and this additional capacity is needed, the cost of the new turbo-generator and its accessories will be around $100 per kva.

Mr. Dow seems to object to the idea that the investment in electrical plant is proportional to the kva. on the generators. This statement, of course, is not exact. We must make allowances for spare capacity, lightly loaded lines in partially developed districts, etc. However, for a system having a high load density, where the transmission lines can be loaded to near their capacity and the ratio of spare capacity to loaded capacity is small, this statement is approximately true.

Duquesne Light Company,
Pittsburgh, Pa. RAYMOND C. R. SCHULZE.

A Criticism of the "Home Lighting Primer"

To the Editor of the ELECTRICAL WORLD:

Now that the "home-lighting" contest is over, I am moved to call attention to some things in connection with the educational part of the program which seem to have "slipped by" and which should not stand without protest or correction. In the midst of the campaign, when all interested in better lighting were working hard to make it a success and "win the war," it was not in order to hinder the movement or confuse the main issue by calling attention to these things, as efforts were better spent at that time in "putting over" the idea.

The whole educational campaign depended largely on the "Home Lighting Primer." The lessons taught there were of vital importance as they were read and studied by thousands of children and parents. It was, therefore, of special importance that a well-balanced presentation should be made. At the beginning of the primer much emphasis is given to avoiding glare, and this is reiterated in various ways throughout the book. In the living room, of all places, avoidance of glare is most important, because it is here that visitors are entertained, and those in the room must often sit facing the luminaires for considerable periods without a chance to shift position and dodge the glare, if glare there be. There is probably no other room in the house, except the dining room, where glare from central ceiling fixtures or brackets can cause more discomfort; because in the other rooms the occupant can shift his position and avoid such annoyances. In view of this it is decidedly surprising to note that among the thirteen pieces of lighting equipment for the living room given in the primer not one is of the semi-indirect or indirect type calculated to give the least glare. A picture of this type is shown among those for bedroom equipment, so it evidently was not out of the minds of the writers of the primer entirely. While it is true that semi-indirect bowls are not being purchased to so great an extent as several years ago, this is hardly a sufficient reason for the omission of this important class of lighting from living-room possibilities. An educational primer of this kind should teach correct principles regardless of passing fads and fancies. Otherwise, we progress (?) in a circle. J. R. CRAVATH.

Pioneer Electric Company,
Richmond, Cal.

Mr. Sachs Replies to His Critics on Meter-Service Switches

To the Editor of the ELECTRICAL WORLD:

In the November 15, 1924, issue of the ELECTRICAL WORLD I submitted an analysis of the meter-service-switch situation. I advocated impartiality in design and presented pro and con facts concerning each of the types discussed and then deduced some logical conclusions. Mr. Palmer and also Messrs. Fryer and Gregory (ELECTRICAL WORLD, December 27, 1924) questioned some of my statements. In matters of opinion relating to meter-service-switch practice it is unnecessary to elaborate on the facts already presented by me or to enter into any extended discussion as to the correctness or incorrectness of the premises taken in either of these letters. Mr. Palmer in his letter, however, contradicts certain statements of fact, and therefore it seems but fair to submit proof in substantiation of these statements.

My article incorrectly credits Mr. Palmer with the conclusion "that a significant difference between an 'AA' switch and an 'A' switch (Underwriters' Laboratories' classification), when both of them embody accessibility of main fuses when dead and prevention of access to live parts, lies in reversibility of connection to the supply and load wires in the former, whereas in the latter it is necessary to connect the supply or line wires to the switch terminals and the load wires to the fuse terminals." Mr. Palmer states that "as a class 'A' switch cannot because of its design embody accessibility of main fuse when dead," he "cannot accept responsibility" and is at a loss to understand this statement. May I direct attention to the long list of manufacturers who produce classification "A" switches which appears in the list of inspected electrical appliances published by the National Board of Fire Underwriters, (April, 1924, issue, pages 185-189, and also the October, 1924, supplement, pages 32 and 33)? Examination of several of such switches (some of which have been extensively marketed) amply proves that it is *not* a fact that a "class 'A' switch cannot because of its design embody accessibility of main fuse when dead."

Mr. Palmer says: "It is impossible to connect an 'AA' switch incorrectly into service." My article says: "Connection reversibility does not guarantee correct installation of an 'AA' switch. An incompetent or careless installer who fails properly to connect the line and load wires to their respective clearly indicated terminals in an 'A' switch will just as likely connect two line wires to switch and fuse parts in the same leg of an 'AA' switch." This statement is based on an actual case where an incompetent installer connected an 'AA' switch in this manner, with obviously disastrous results when the switch was first closed with current on line.

Mr. Palmer asserts that "every one of the utilities which originally accepted with enthusiasm the inaccessible service fuse now insists upon classification 'AA' switches at every service entrance." Surely this can only refer to "certain utilities of this country," as it is a most readily demonstrable fact that the utilities which "now insist upon classification 'AA' switches at every service entrance" are exceedingly few as compared with those that insist upon a sealed meter-service switch with "inaccessible service fuse."

Without debating with Mr. Palmer meter connection practice where "AA" switches are used, I submit that the dominating practice is to use inside connected potential coil meters as generally marketed by the several meter manufacturers. In regard to meter-service-switch devices provided with accessible load side in addition to sealed service side fuses, I speak only from such experience as I have, which has proved, at least to me, that devices of this double-fused type possess to some extent the feature indicated.

That "standardization of the service entrance is . . . carried to a much more logical conclusion with the classification 'AA' switch than with the types of switches suggested by Mr. Sachs" is simply a matter of opinion. Messrs. Fryer and Gregory do not flatly deny any of the facts presented in my article. However, they question whether or not the so-called standardized meter-service switch is a reality or a phantom. The existing easily demonstrable facts speak for themselves.

"Standardized" practice is not necessarily founded upon enactment by authoritative bodies, nor even if so sponsored, is authoritative enforcement insured. A method or device which is accepted and used extensively in an art or industry may be aptly termed as standard. I submit the following in reply to the questions propounded by Messrs. Fryer and Gregory:

1. The term "standardized" meter-service switch refers to those of generally common design and size and with interchangeable fittings (at least so far as the inclosing cabinet and meter protective parts are concerned), as produced by several manufacturers and adopted and specified by many utilities.

2. It has not been claimed that "standardization" of meter-service switches has been set forth by any authoritative body or association. Justification for considering such switches as "standardized" is based on the fact that they have been adopted as standard practice by a large proportion of the utilities composing the N. E. L. A.

3. Specifications for a "standardized meter-service switch" will be found in the rule books of many utilities throughout the country. Comparison of these will demonstrate that at least in some particulars there is ample basis for the claim that there is a "standardized" or common practice in regard to such meter-service switches.

4. Mr. Fryer (as a member of that committee) is in the best position to know just what the N. E. L. A. committee has "definitely declared." I am not aware of any official communication issuing from the N. E. L. A. committee to the manufacturers of meter-service switches declaring against the term "standardized meter-service switch."

I regret that my effort to present meter-service-switch facts has seemingly been accepted as an invitation for an extended debate on this subject, but I trust that it will be found that my statements are based on sufficiently well-established facts to make further verbal gymnastics unnecessary.

JOSEPH SACHS,
Chief Engineer.
Johns-Pratt Company,
Hartford, Conn.

[NOTE.—The ELECTRICAL WORLD has presented to readers a series of articles and letters on the meter-service-switch question in order to bring out constructive facts and opinions on this important subject. This purpose having been served, it considers it inadvisable to continue the discussion of the subject in its pages. Actual operating experiences and data must be obtained for bringing out additional material on this subject for the benefit of the industry.—EDITOR.]

Ohio Power Company's Transmission System

To the Editor of the ELECTRICAL WORLD:

The issue of the ELECTRICAL WORLD for January 3, 1925, contains a supplement giving engineering details of the transmission lines in the United States at and above 44,000 volts. This supplement has entirely disregarded the most important transmission development in Ohio in 1923 and 1924. During these years the Ohio Power Company built and put into operation a 132-kv. steel-tower line running from our new Philo plant, on the Muskingum River, 7 miles from Zanesville; a 73-mile line to Canton, Ohio, and a 15½-mile line to Crooksville, Ohio. The conductor is 336,400 A.C.S.R. and the towers average four and a quarter per mile. The approximate cost was $1,500,000. We also built the line from Fostoria to Lima, Ohio—44.65 miles in length—with the same type of construction. This line is listed on page 19 of the ELECTRICAL WORLD under the name of the Ohio Gas & Electric Company. Just where this name came from I have no idea, as none of our subsidiaries was ever known by such a name.

In the supplement you list the line under the West Penn Power Company from Windsor, W. Va., to Washington, Pa. However, the line from Windsor to Canton, Ohio, which is 55 miles long and one of the most successful 132-kv. lines in the country, is not mentioned. Our company would, I am sure, be pleased in the future to supply any such information you may wish as a matter of co-operation to help in getting the correct data.

M. P. KERR,
Construction Superintendent.
Ohio Power Company,
Canton, Ohio.

[All holding company headquarters were asked by the ELECTRICAL WORLD to fill out forms giving transmission-line data, and in the majority of instances they did so. A complete tabulation of all lines could only be made by obtaining complete data, and it is hoped that this initial attempt to record needed information will lead to better co-operation in the future. The comments of Mr. Kerr are well taken, and the ELECTRICAL WORLD thanks him for the data and corrections that he supplies with reference to the Ohio Power Company.—EDITOR.]

Central Station and Industrial Practice

Experiences with Lightning Trouble in Austria

BY R. W. PRUESSER*

THE numerous high-voltage lines which have been built during the last few years in Austria in order to utilize the available water power as far as possible suffered considerably through lightning at first. Some of these lines run for stretches of 150 km. or more over very varied territory — woods, swamps, fields, etc.—and carry a voltage of from 12,000 to 20,000. At first considerable difficulty was experienced in locating the trouble zone, but it has at last been possible to divide the system into relatively short sections, the limits of which are within easy reach of both the service and the public telephones so that no time is lost in reporting trouble. As soon as trouble is reported two trouble gangs start out, one from each end of the section, until its location is found. The following interesting facts have developed in the course of operations.

It was found that with a span of 150 m. secondary discharges damaged the insulators as far as five poles away from the main discharge of lightning. In two cases secondary charges struck the insulators more than a kilometer away from the main one and were sufficiently strong to melt them partly. As porcelain bell insulators are used exclusively, it was possible to observe the effect of the lightning on them. Wherever a main discharge had taken place the insulators were either cut in half lengthwise in almost even parts, bits of molten porcelain remaining stuck to the iron support, or comparatively small pieces were chipped off, leaving the head intact.

The effect of the secondary discharges was, as a rule, a barely visible crack running from the head downward and terminating in a small knob of fused porcelain.

One of the puzzling features was that lightning seemed to strike in restricted sections and that parallel lines a short distance from those hit were hardly ever damaged. We finally found that the lines giving the most trouble were close to subterranean water courses, and after high lightning conductors had been erected close to the lines no further trouble was experienced. We also noted that lightning seemed to avoid angle poles and to strike in the middle between two such angles.

One of our lines ran through a gully which was heavily wooded with pine trees. This section was frefrequently struck by secondary discharges. Continued observation showed that the main discharge always struck among the comparatively few leafy trees growing in the wood.

After we had felled all trees in the vicinity of the lines, this section was much less subject to damage from lightning. Another section which was exceedingly troublesome until numerous conductors had been erected ran through a swamp.

The general lesson we have drawn from these and similar experiences is that subterranean watercourses should be carefully avoided when high-voltage lines are being built. Should it be impossible to do this, it is essential that separate circuit breakers be built on both sides of the line and that the sections be made as short as possible. We have also found that it is a good plan to build at regular intervals along the line lightning conductors which are several meters higher than the poles. Their great advantage is independence from the system and economy in construction. These lightning conductors or ground wires have proved very efficient and have been in fairly general use in Germany since the war.

*Electrical engineer for Vienna Institute of Scientific Auxiliary Work and consulting engineer for Australian government Electric Power Commission, Vienna.

Transmission-Line Tower Design Chart

BY H. L. SHARP

Engineering Department, Niagara, Lockport & Ontario Power Company, Buffalo, N. Y.

IN THE design of towers for electric power transmission lines it is becoming common practice to make the foundations of structural steel and bury them in the earth without concrete. The resistance of each foundation to the force tending to lift it out of the ground depends on the nature of the soil, on the dimensions of the base of the foundation and on the depth to which it is buried.

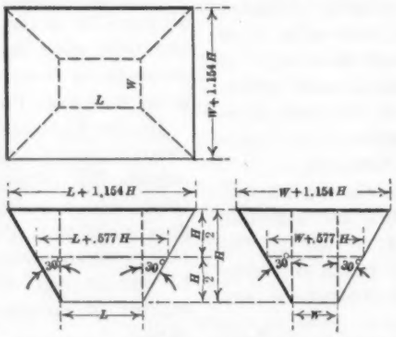


FIG. 1—BASIS FOR NOMOGRAPHIC CHART FORMULA FOR TRANSMISSION LINES

In order to determine readily the effect of a change in the depth of the foundation, or in the dimensions of the length or width of its base, Fig. 2 has been prepared. Full directions for using the chart are to be found in the footnote of Fig. 2.

The resistance to uplift is usually considered as the weight of a prismoid of earth whose lower base has the length and width of the base of the steel footing and whose sides are inclined outward from that base at angles of 30 deg. to the vertical. Ordinary earth is assumed to weigh 100 lb. per cubic foot.

The volume of a prismoid $= H/6(A_1+4A_m + A_2)$, where H is the altitude of the prismoid (or depth of the footing), A_1, A_2 and A_m are the areas of the upper base, lower base and section midway between the bases respectively. In the case under consideration the slope of all the sides of the prismoid is uniform at 30 deg. to the vertical, and therefore the area of the top base and of the middle section are functions of the depth of the footing and of the dimensions of its lower base.

In Fig. 1 let the base of the footing have a length L and width W and let the depth be H. Tangent of 30 deg. $= 0.577$.

Then the length of the middle section is $L + 2 \times 0.577\ (H/2) = L + 0.577H$.

The width of the middle section $= W + 2 \times 0.577\ (H/2) = W + 0.577\ H$.

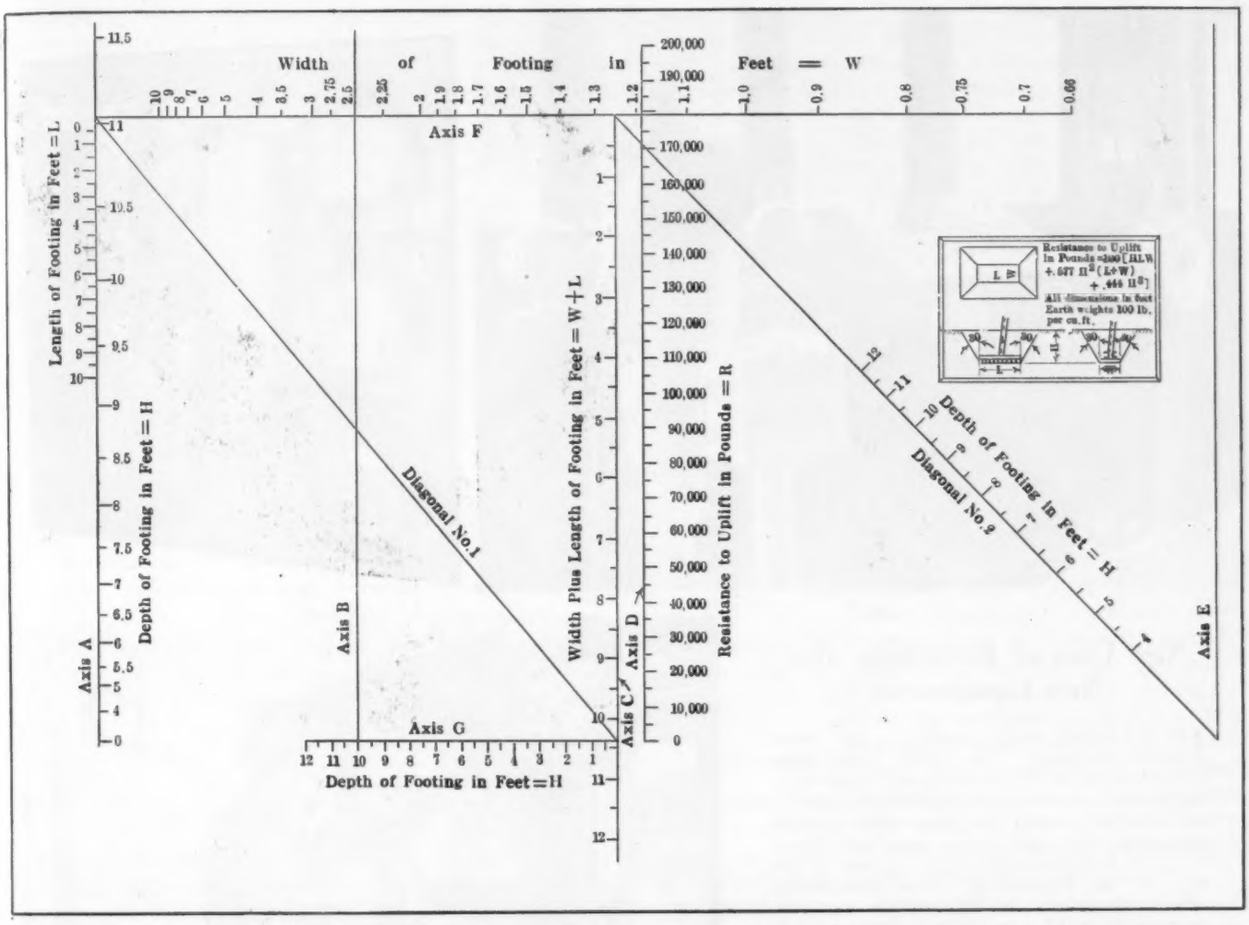

Width of Footing in Feet = W
Axis F
Length of Footing in Feet = L
Depth of Footing in Feet = H
Axis A
Axis B
Diagonal No. 1
Axis G
Depth of Footing in Feet = H
Width Plus Length of Footing in Feet = W + L
Axis C
Axis D
Resistance to Uplift in Pounds = R
Diagonal No. 2
Depth of Footing in Feet = H
Axis E
Resistance to Uplift in Pounds = 100 [HLW + .577 H² (L+W) + .444 H³]
All dimensions in feet
Earth weights 100 lb. per cu. ft.

FIG. 2—CHART FOR DETERMINING THE RESISTANCE OF UPLIFT OF STRUCTURAL STEEL FOOTINGS FOR TOWERS

Directions for Using Chart.—Draw a straight line from W on axis F to H on axis G and note its intersection with diagonal No. 1. Draw a line from L on axis A through the point just located on diagonal No. 1 and extend the line to intersect axis C. Draw a line from the point just located on axis C to H on axis A and note its intersection with axis B. Draw a line from $W + L$ on axis C to H on diagonal No. 2 and extend the line to intersect axis E. Draw a line from the point just located on axis E to the point previously located on axis B. Its intersection with axis D gives the resistance to uplift of the footing in pounds (neglecting the weight of the steel in the footing itself).

The area of middle section A_m
$= (L + 0.577\,H)\ (W + 0.577\,H)$.
$= LW + 0.577\,LH + 0.577\,WH + 0.333\,H^2$.

The length of the top base
$= L + 2 \times 0.577\,H = L + 1.154\,H$.

The width of the top base
$= W + 2 \times 0.577\,H = W + 1.154\,H$

The area of the top base A,
$= (L + 1.154\,H)\ (W + 1.154\,H)$
$= LW + 1.154\,LH + 1.154\,WH + 1.332\,H^2$.

Substituting these values in the equation for the volume of a prismoid and simplifying:

$$V = HLW + 0.577\,H^2\,(L + W) + 0.444\,H^3.$$

With the weight of the earth 100 lb. per cubic foot, the resistance to uplift:

$$V = 100\,[HLW + 0.577\,H^2\,(L + W) + 0.444\,H^3].$$

This is the equation on which the chart is based.

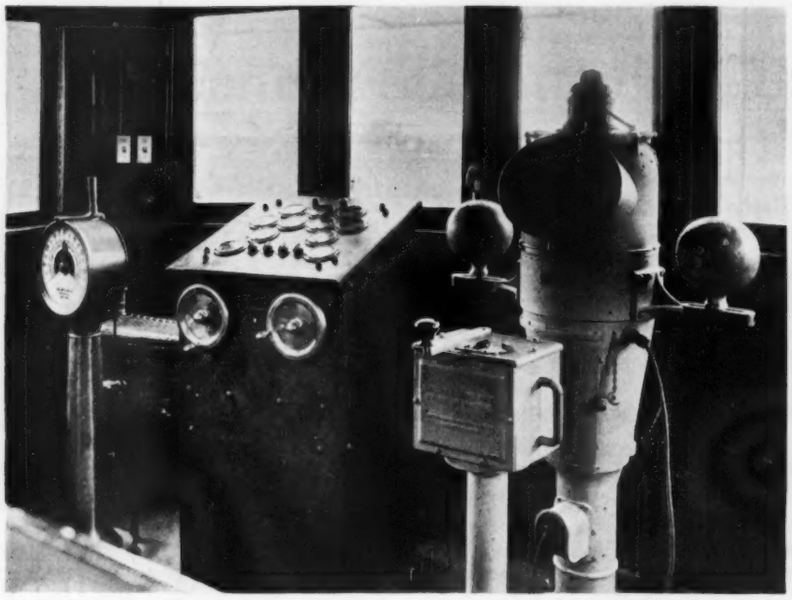
It will be noted that the weight of the steel in the footing has not been included. The space occupied by steel has been considered as earth weighing 100 lb. per cubic foot. Steel weighs nearly 500 lb. per cubic foot. Therefore the weight of the steel footing can be included by adding four-fifths of the actual weight of steel to the value obtained from the chart. This refinement is hardly necessary in practice.

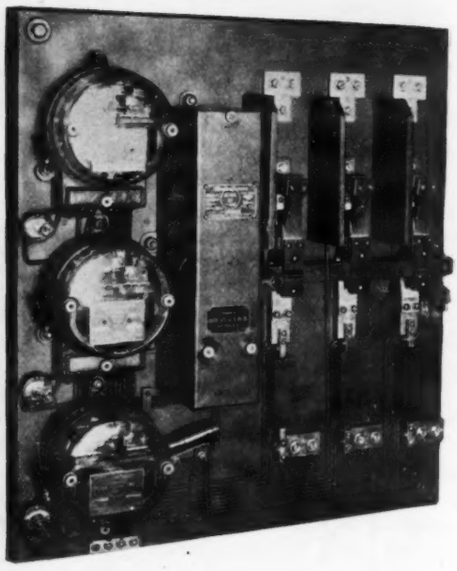
Aërial Cables Versus Open Wiring

ONE of the most common sources of trouble and interruptions to distribution circuits is the shade trees which line the streets, according to the report of the overhead distribution committee (I. O. Montignani, chairman), presented before the recent convention of the Empire State Gas and Electric Association at Syracuse, N. Y. No matter how liberal the trimming privileges granted by city officials or private owners, shade trees at times get beyond control and cause serious trouble. Mr. Montignani pointed out that the complete remedy for such conditions is underground construction, but that this in the majority of cases cannot be economically justified, and so alternatives have to be sought.

Among these are the use of the so-called tree wire and protective sheathings which afford some immunity from the abrasive action of tree limbs, but add little to the mechanical strength of construction. One company reports having with some success tried bunching the conductors by tying them together with marlin or friction tape on the theory that one good open space is easier to find than are paths for the several conductors of the circuit.

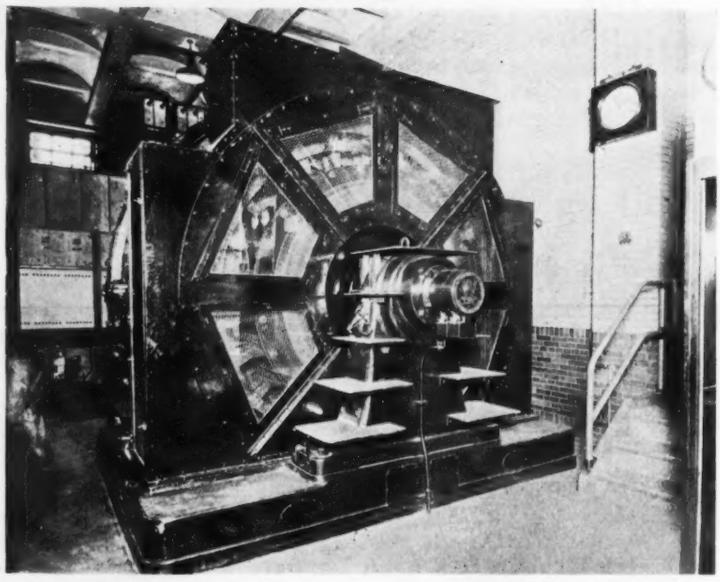
As a compromise between open-wire construction and underground cable comes aërial cable construction, usually lead or jute and steel-armored cable suspended from a steel messenger wire and hung low

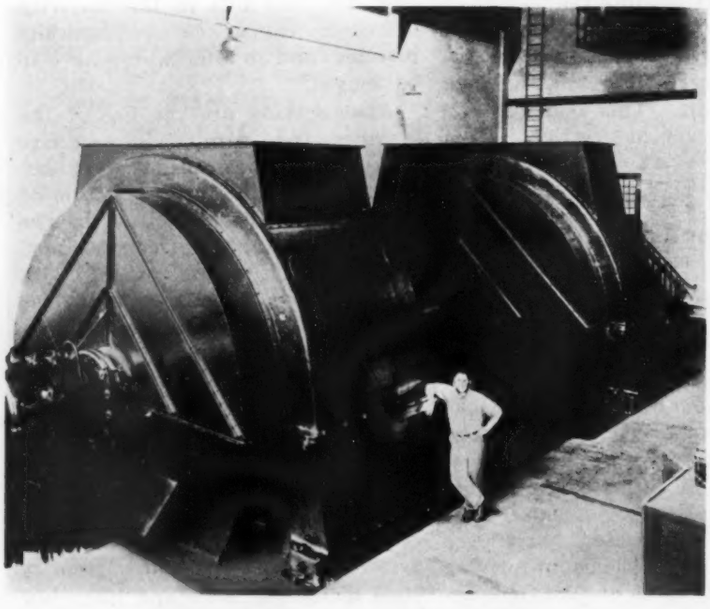


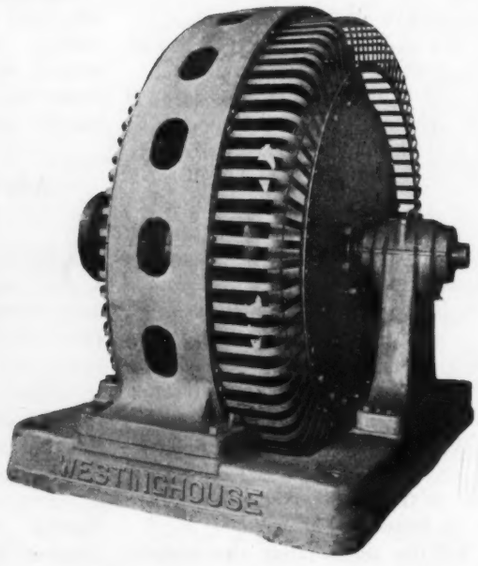


New Uses of Electricity and New Equipment

IN MARINE work electricity has made great headway. The initial installation of electric drives for colliers and battleships has proved so successful that electric drives are now being used for many other marine purposes. The view in the upper left shows the pilot house control room for one of the four U. S. Engineers' Corps electrically driven dredges. At the upper right is shown a view of a new alternating-current network protector installation for use in metropolitan areas. At the right center is shown a new installation of flashover barriers for a large rotary. At the left bottom is a view of a large frequency changer set used to connect large metropolitan systems operating at 25 and 60 cycles. At the lower right is shown a new synchronous motor with a built-in magnetic brake.







enough to avoid the most troublesome branches of trees.

This form of construction is being extensively used for tie lines or transmission lines up to 16,000 volts. In such lines this construction can usually be shown to be economically sound in spite of its much greater cost as compared with open-wire construction. It is comparatively free from tree trouble, it is practically immune from lightning disturbances, and on account of low reactive losses a larger conductor cross-section can be employed with correspondingly greater carrying capacity per circuit than with the limited conductor size of open wiring.

For general distribution, however, the necessity of frequent tap-offs for transformers, branch lines, etc., makes aërial cable construction a more complicated problem, and consequently it has not been used to any notable extent for that class of service.

It seems reasonable to expect, however, that suitable and economical tap-off devices may be developed and aërial cable construction become widely used where such conditions as have been described would warrant the expenses.

Conduit Spillway Plant Has 65-Ft. Head

New Station of Consumers Power Company Has Two 8,888-Kva. Units—Unusual Arrangement of Exciters Insures Stability of Operation

ANOTHER hydraulic plant involving conduit spillways built into the power house proper, to operate at the highest effective head thus far developed by the Consumers Power Company in Michigan, is well under way and is expected to be delivering power to the company's 140,000-volt transmission system by June 1, 1925. The plant is situated on the Manistee River, 28 miles northwest of Cadillac and 12 miles upstream from the Junction hydraulic plant of the Consumers Power Company, with which it is connected by steel-tower transmission lines now supplying energy for construction purposes at 40,000 volts, but later to deliver power to the system at 140,000 volts. The plant has been given the official name of Hodenpyl in honor of A. G. Hodenpyl, director of the Consumers Power Company and an active financial pioneer in the central-station industry of Michigan.

Earth Embankment with Concrete Core Wall

The plant will operate under a head of 65 ft. until the Sibley site, a short distance down stream, is developed, when it is expected that the lower pond will raise the Hodenpyl tailrace 3 ft., giving an effective head of 62 ft. The dam is similar to most of the other dams used by this company, being an earth embankment with a concrete core wall. The foundation soil under the dam is a dense red clay. Because of the character of the drainage area serious floods are virtually unknown and there is a good flow during the dry season, making the Manistee River one of the steadiest inland streams in the United States.

Conduit Spillway Construction

The Hodenpyl plant involves conduit spillways built into the power-house structure, designed and patented by W. W. Tefft, chief engineer of the Consumers Power Company. These spillways are similar to those already in successful use at the Mio and Alcona plants on the Au Sable River. Six conduits of rectangular cross-section, each 9 ft. x 12½ ft. at the upper end, have been built into the plant substructure. An emergency spillway is provided at the north end of the dam, but it is very unlikely that this will ever be used. Each of the spillway tubes will be controlled by a caterpillar gate. The penstocks will be controlled by four tainter gates, each 20 ft. x 20 ft. Two gates will be placed in each bay.

Both the caterpillar gates and the tainter gates will be handled by a heavy hoist operating on a gantry which will run the length of the penstock. In addition to raising all the gates, this hoist will lift any caterpillar gate from its frame for periodical inspection. A spare caterpillar gate will be provided. In addition, the gantry will carry on its under side a runway for an electric hoist to handle the mechanism to clean the racks of driftwood and other débris that may collect. This material will be loaded onto small dump cars and finally burned.

The trash racks are the deepest of all on the system, the main racks being about 40 ft. high and the heavy lower racks extending down to about 60 ft. under the headwater. These present unusual problems in cleaning and will require special equipment operated by electric hoist as already mentioned. A drift catcher is installed with a log boom to catch floating débris. The steel rack beams and trusses are designed to withstand the full hydrostatic head. In case of unusual breakdown concrete stoplogs, spanning more than 40 ft., may be dropped into the grooves provided to shut off the water from the penstocks and spillway tubes.

Two generating units, both furnished by the Allis-Chalmers Manufacturing Company, are to be installed, each driven by a 12,000-brake horsepower vertical-shaft, single-runner turbine with a plate-steel spiral casing. The generators are each rated at 8,888 kva., 7,500 volts, three-phase, 60 cycles. A 250-volt shunt-wound exciter, the field of which will be excited by a 125-volt self-excited auxiliary, is provided. The rotating parts of the prime movers will be supported on Kingsbury thrust bearings.

Speed regulation of each unit will be provided by an Allis-Chalmers oil-pressure governor with two "servo motors" applying force at diametrically opposite points on the shifting ring. The fly balls will be mounted on the main generator shaft and their movements will be transmitted to the valve mechanism by levers and rods that will obviate any lost motion. The governors will operate at about 200 lb. pressure and will move the gates through their entire range in two seconds.

Stability of Operation Insured at All Times

The unusual arrangement of exciters mentioned is to insure stability of operation under conditions necessitating a weak generator field. Field regulation is accomplished by electrically operated and interlocked rheostats in the fields of the auxiliary exciter, the main exciter and the generator. These rheostats are so arranged that they are operated by one double-throw control switch. This method assures operation with the fields of the exciters well above the knee of the saturation current at all times.

Differential-relay protection will

be provided on the generators so that in the event of trouble in the winding the unit will be disconnected from the line, the field opened, the machine shut down quickly by the interlocking action of the generator oil breakers, the field circuit breakers, governor and air brakes.

PLANT TO BE OPERATED BY JUNE

Preliminary work on this project began November, 1923, but actual construction did not commence until May, 1924. The plant is scheduled to deliver power June 1, 1925, and at the present rate of construction it will be completed during August, 1925. The rapid progress being made is due largely to the use of modern up-to-date construction equipment. Drag-line excavation machinery is used extensively. Four construction locomotives are kept busy hauling gravel, dirt and other material; three locomotive trains handle the material used in building the power-plant structure; a 205-ft. tower and a large belt conveyor are used to make the big embankment. Most of these mixing machines are in use twenty-four hours a day.

The concrete-mixing plant, situated on the river bank opposite the structure, is one of the prominent and interesting features of the development. Motor-driven mixers at the main plant have a capacity of 1,000 yd. of concrete in twenty-four hours. Three other mixers are used for plant and core-wall construction having a capacity of about 1,300 yd. At the main mixing plant two buckets each carrying one yard elevate the concrete to the top of the tower beside the mixing plant. From this it is carried by gravity down a long spout to the distribution tower close to the plant structure. From the latter the concrete is poured into the forms on the various parts of the installation.

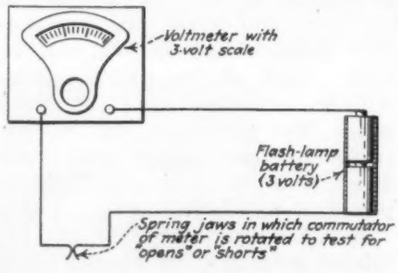
Testing for Faulty Meter Armatures

BY KARL H. BAUSMAN
Supervisor of Meters Dayton (Ohio) Power & Light Company

TO FACILITATE the testing of direct-current meter armatures to determine whether they are short-circuited or otherwise defective the Dayton Power & Light Company has installed in its meter repair room a very simple device which saves considerable time.

The principle applied is to connect a voltmeter in series with a source of low voltage and complete the circuit through armature commutator segments of the meter armature. In this case the low-voltage source consists of two flash-lamp-type dry cells connected in series (producing about 3 volts), and the meter is a large-scale instrument reading up to 3 volts full scale in units of 0.02 volt. For making contact with armature segments of the meter armature commutator, two copper strips are attached to the panel carrying the voltmeter and dry cells and held in such a position that proper contact will be made with the commutator when it is slipped between them. One of the jaws is connected with the voltmeter and the other with the dry cells to complete the series circuit.

When the commutator of the watt-hour-meter armature is placed between the jaws, a reading somewhat less than 3 volts will be obtained on the voltmeter, depending on the coil resistance of the armature. If there is an open circuit in the coils between opposite segments, the voltmeter will read zero, and if there is a short circuited coil, the voltmeter will read somewhere above the normal value, depending on the extent to which the coil is short-circuited. By twirling the armature when the commutator


Voltmeter with 3-volt scale
Flash-lamp battery (3 volts)
Spring jaws in which commutator of meter is rotated to test for "opens" or "shorts"

ARRANGEMENT OF CIRCUIT FOR TESTING METER ARMATURES

is between the jaws and observing the voltmeter needle it is possible to tell very quickly if the coils are intact. If they are, the voltmeter needle will remain at one place on the scale instead of fluctuating. Any tendency to depart from this position will indicate a faulty coil, showing the armature to be defective.

Provision is also made to test the armature of a direct-current meter in position without removing the armature from the meter.

Construction Costs at Davis Bridge

PRINCIPAL items entering into the construction cost of the Davis Bridge hydro-electric development of the New England Power Company are given herewith based on an analysis of the work of the Power Construction Company, Worcester, Mass., on this project. This development, which was described in the ELECTRICAL WORLD for June 16, 1923, includes a storage reservoir of 38,000,000-gal. capacity, an earth dam 200 ft. high and 1,250 ft. long, a power tunnel 2.4 miles long with a normal capacity of 1,400 cu.ft. per second, two steel penstocks delivering water under 390 ft. maximum head to two 20,000-hp. Allis-Chalmers vertical waterwheels, each driving a 16,000-kva. General Electric generator, and a brick and concrete station building, with outdoor switching yards. The building is large enough for a third unit, as is the penstock trench. The total cost of the project up to the high-tension lines, including interest during construction and engineering, but excluding original properties and water rights, was $9,000,000.

PRINCIPAL ITEMS OF COST AT DAVIS BRIDGE

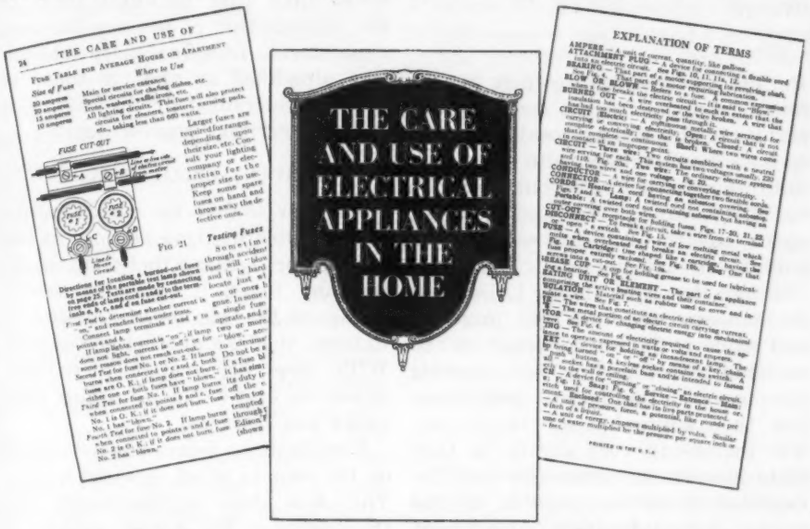
1.	Preliminary surveys, test pits and borings	$80,000
2.	Main camp buildings and equipment	60,000
3.	Camp operation (net loss over three-year period)	20,000
4.	Highway changes	150,000
5.	Clearing reservoir basin	60,000
6.	Railroad relocation (9 miles)	560,000
7.	Temporary roads, railroad changes and sidings	70,000
8.	Earth dam (1,900,000 yd.)	1,900,000
9.	Diversion tunnel and spillway	900,000
10.	Control tower	160,000
11.	Pressure tunnel (12,781 ft.)	1,750,000
12.	Surge tank and interconnections to tunnel and penstocks	230,000
13.	Penstocks (two installed)	170,000
14.	Power house and equipment (two units installed)	1,000,000
15.	Interest during construction	530,000
16.	Field engineering	135,000
17.	Administration, engineering and construction fee	450,000

NOTES.—Item 1—Includes about $45,000 expended for surveys and studies extending over several years and $35,000 for test pits and borings covering dam sites, borrow pits, tunnels and power house. Item 2—Headquarters camp only, including capacity for 450 men. Item 5—Cost of clearing about 800 acres; cost per acre $75. Item 7—Includes cost of changing and operating H. T. & W. R. R. through the dam construction activities over an eighteen-month period, amounting to $42,000. Item 9—Combined cost of handling water during construction and providing adequate spillway structure. Item 11—About $136 per foot of length. Item 12—Includes rock excavation and concrete, $50,000; steel surge tank (420 tons), $56,000; manifold and interconnecting steel, $51,000; gates and flanges (two units), $32,000. Item 13—Excavation, concrete and backfill, $65,000; steel, $105,000; the third penstock will cost about $60,000. Item 14—The additional unit installed will cost about $220,000, giving a total unit cost of $27 for power house and equipment on a 45,000-kw. capacity. Item 16—Field engineering payroll plus expenses of $11,000.

Commercial Activities and Public Relations

Teaching Customers to Care for Appliances

MUCH time and effort have been expended by central-station companies to keep household electrical appliances in working order, but because it was generally believed that the public would not understand the somewhat technical terms necessary in explaining the operation of electrical devices very little has been done toward educating residential customers to take care of their equipment and make minor repairs and adjustments.



INFORMATION GIVEN CUSTOMERS ON PROPER CARE OF ELECTRICAL EQUIPMENT

This problem has, however, been attacked with beneficial results by the Newport (Vt.) Electric Light Company by the distribution to each of its customers of a booklet, "The Care and Use of Electrical Appliances in the Home," which explains in a popular manner the causes of and remedies for almost every kind of electrical trouble which a customer is likely to experience.

Explaining his company's reasons for distributing this booklet and the results obtained, John A. Prauty, manager of the Newport Electric Light Company, says: "We felt that if we could teach our customers something more about their electrical appliances it would not only be a great benefit to ourselves in gaining their good will but also a distinct advantage to the customers themselves. One of these little booklets has been given to each customer, and in this way they have acquired a great deal of knowledge that we could not give them except by the intensive and expensive work of having a man call on each one. By their having this information to refer to they always have something which will show them how to rectify a great many of the troubles that any one using electrical energy sometimes encounters.

"As far as we are able to check up the results both in collecting our bills and also in the fewer number of times that customers called upon the company for repairs, we feel that the plan has worked out very well."

While it is admittedly difficult to explain to the lay mind the higher technicalities of electrical phenomena, the ease with which intricate details concerning the operation of radio apparatus have been absorbed indicates that it should be possible to explain the comparatively simple operations of domestic appliances so that they can be readily understood by the public. From the response of its own customers the Newport Electric Light Company believes that it has hit upon a practical method of doing this.

Ground-Floor Store Helps Appliance Sales

A SHORT time before the holiday season the appliance department of the Worcester (Mass.) Electric Light Company was moved out of the basement location which it had occupied at the company's main offices and established in an adjoining building, giving the department a ground-floor situation accessible from the main offices and also a separate street entrance.

The new appliance shop is about 40 ft. long by 18 ft. wide, with a manager's office at the rear affording ample space for the conferences and private demonstrations which in the past interfered at times with the closing of sales in the former rather cramped quarters. Customers entering the department from the main offices pass the power sales department en route, whereas formerly both departments were "dead-ended" with no direct connection.

PORTABLE-LAMP DISPLAY IN WORCESTER ELECTRIC LIGHT COMPANY'S NEW SHOWROOM

The main-office floor space has been utilized to a fair degree for appliance display, but ever since the company moved into its present quarters the basement location of the department has been a handicap. O. R. Underhill, appliance manager, massed portable lamps with very little duplication for the holiday trade, about eighty units being shown in the new quarters, and December sales ran about 10 per cent ahead of a year ago.

House Wiring Increases Residential Revenue 353.5 per Cent

Eleven Years of Continuous Selling by Central-Station Company Has Added 5,092 New Customers in a Town of 22,000 Population

BY L. T. WHITE
New Business Manager Danbury & Bethel Gas & Electric Light Company
Danbury, Conn.

HOW important the wiring of old houses is to a central-station company as a means of adding new customers and increasing domestic revenue is strikingly illustrated in the results obtained by the Danbury & Bethel (Conn.) Gas & Electric Company. The experience of this company in its house-wiring activities, which extend back over a period of eleven years, offers an unusual opportunity to contrast the rapid growth of a company's revenue under the stimulation of a new-business department as compared with the slow rate of increase when no sales effort was put forth.

The original Danbury Electric Light Company was organized and its operation begun in 1883 by local pioneers who built the plant, ran some lines and settled back into a more or less passive attitude. Little attention was paid to developing the business, and the small increases in customers and revenues came about through house owners taking the initiative in having their houses wired, applying to the company for service. The management appeared to have been content with this slow, natural growth of the business, for in 1913—after thirty years of operation—the company was serving only 1,520 customers.

About that time Henry L. Doherty & Company acquired the property and made a thorough survey of the possibilities of adding new electric customers. Danbury's population was then approximately 19,250 and was increasing very slowly, so that little increase in customers could be expected from the growth of the town. A new-business department was organized and plans were laid to increase the use and sale of electrical energy for domestic purposes.

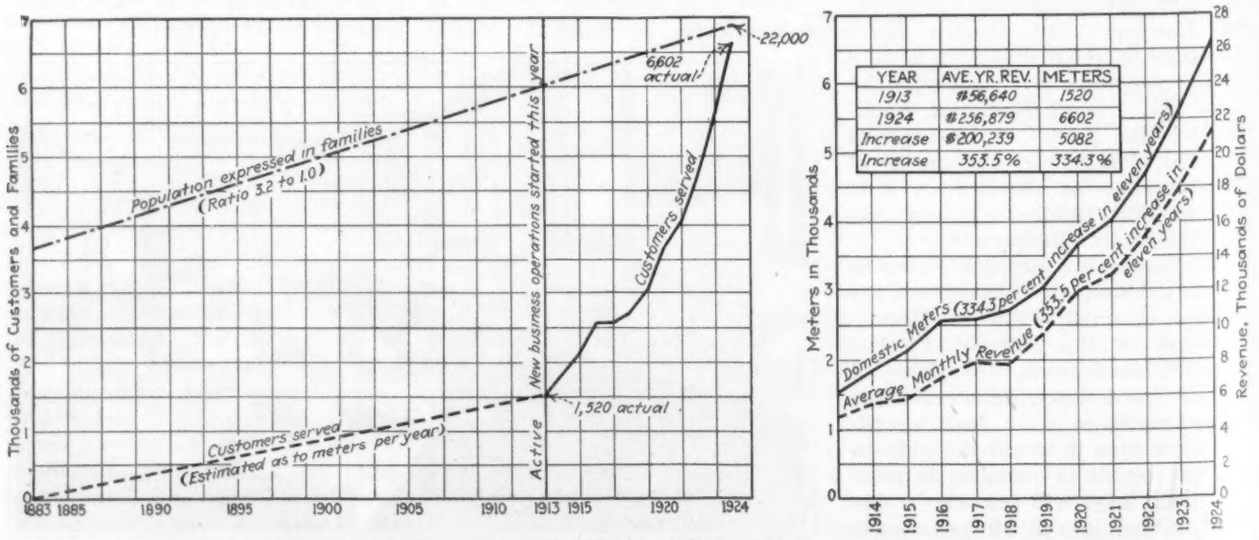
One of the first problems undertaken by the new-business departmen was the addition of new customers by wiring old houses. The local electrical contractors were called together, the situation was discussed, and they were asked to submit tentative prices for house wiring. When these were received a standard scale of prices was prepared. These prices were based on the number of lighting, baseboard and switch outlets and were determined by the company adding to the contractors' prices a charge to cover selling costs and other incidental expenses. The company promised the contractors a volume of business larger than they had ever thought possible, which enabled them to offer a final price schedule much lower than that in effect prior to the organization of the new-business department. This final price schedule was simplified so that it could be readily understood by the customers and the territory representatives.

COMPANY SELLS FIXTURES

In order to give the customers the best possible lighting equipment and service for lighting their homes, the company found it advisable also to engage in the sale and installation of fixtures, shades and other accessories. With these preparatory steps completed the first old-house-wiring campaign was launched.

New-business representatives called on the owners of all unwired houses. This was done systematically and thoroughly. To house owners a complete job was offered at greatly reduced prices. The representatives figured the total cost on the spot, avoiding any delay in getting a contractor to make an estimate.

The first campaign was a complete success. After several months of intensive selling, the attention was shifted to other activities, but house


Thousands of Customers and Families
Population expressed in families
(Ratio 3.2 to 1.0)
22,000
6602 actual
Customers served
(Estimated as to meters per year)
Active
New business operations started this year
1,520 actual
Customers served
1883 1885 1890 1895 1900 1905 1910 1913 1915 1920 1924
Meters in Thousands
Revenue, Thousands of Dollars
YEAR | AVE. YR. REV. | METERS
1913 | $56,640 | 1520
1924 | $256,879 | 6602
Increase | $200,239 | 5082
Increase | 353.5% | 334.3%
Domestic Meters (334.3 per cent increase in eleven years)
Average Monthly Revenue (353.5 per cent increase in eleven years)
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924

AT LEFT—INCREASE IN RESIDENTIAL CUSTOMERS FROM 1883 TO 1924—PRESENT RATIO POPULATION TO METERS, 3.2 TO 1.
AT RIGHT—AVERAGE MONTHLY DOMESTIC ELECTRIC REVENUE AND NUMBER OF DOMESTIC METERS, DANBURY, 1913 TO 1924

wiring was continued along with all efforts of the department. In the first year 310 new customers were added, which would have required about six years under the methods used prior to the formation of the new-business department.

CAMPAIGN CONTINUES

From that time on the old-house-wiring activity has never ceased. The original plan has never been altered. Prices and details have been changed to meet changing conditions, but the methods employed eleven years ago are still bringing in new customers.

TABLE I—AVERAGE NUMBER CONTRACTS CLOSED PER MONTH OVER ELEVEN-YEAR PERIOD

Month	Number
November	50.0
September	45.8
August	45.5
March	44.0
April	43.6
December	42.1
May	41.9
October	40.5
June	39.5
January	27.0
February	21.0
July	21.0

The Danbury new-business department's records show that November is the best month in which to sell house wiring, while July is the poorest month. November is, of course, a month of short days, when people are interested in house lighting, while July is a month of long days and pleasant weather with relatively little use for light. Table I, showing the months and the number of contracts taken over the eleven-year period, summarizes the Danbury company's experiences in monthly sales. It will be seen that the four-month period for August to November, inclusive, offers the best opportunity for house wiring. During this period in Danbury 39.27 per cent of the average year's contracts were obtained. In March, April, May and June 36.51 per cent of the year's business was done, while the remaining four months produced 24.22 per cent of the average year's contracts.

COMPARISON OF RESULTS

For the thiry-year period 1883 to 1913, before the acquisition of the property at Danbury by Henry L. Doherty & Company, the development of the business was left to agencies not connected with the company. During that period only 1,520 new customers were added, and the gross domestic lighting revenue increased from nothing in 1883 to $56,640 per year in 1913, an average increase of $1,888 per year.

In the eleven years since 1913 the development of the company has been stimulated by the new-business department through intensive selling methods. During this period 5,092 customers have been added to the lines of the company—an increase of 334 per cent. During the same period the total gross domestic lighting revenue increased from $56,640 in 1913 to $256,879 in 1924—an increase of 353.5 per cent. This is an average yearly increase of $18,203 per year, as compared with an average of $1,888 under the old policy.

The survey made in 1913 showed that little development of electric business could be hoped for from increased population. That this prediction was well founded is seen from the fact that the population of Danbury has increased only 14.3 per cent in the last eleven years. This is a growth of 2,750 people, from 19,250 in 1913 to 22,000 in 1924. Reducing this increase in population to families, the town of Danbury has been enlarged by only 786 families since 1913.

ANNUAL SALES PER CUSTOMER $23.23

The Danbury company's domestic electric appliance and installation sales for the last twelve months were $142,496, or sales per customer of $23.23—an average of $6.48 sales of electrical appliance and installations for each man, woman and child in the town of 22,000.

The total wiring and fixtures sales alone for the eleven years since the organization of the new-business department have been $363,805, an average of $33,073 per year. This business has resulted in a total merchandise profit of $34,575.

CONCLUSIONS

The results obtained in Danbury appear to warrant the following definite conclusions:

1. If the developments of the domestic lighting field had been left to interests independent of the company, only a small increase in customers and gross domestic lighting revenue would now be enjoyed by the company.

2. The intensive selling method has gained a large increase in customers and permits the company to enjoy the benefits from these increased customers long before they would otherwise have been added to the lines of the company.

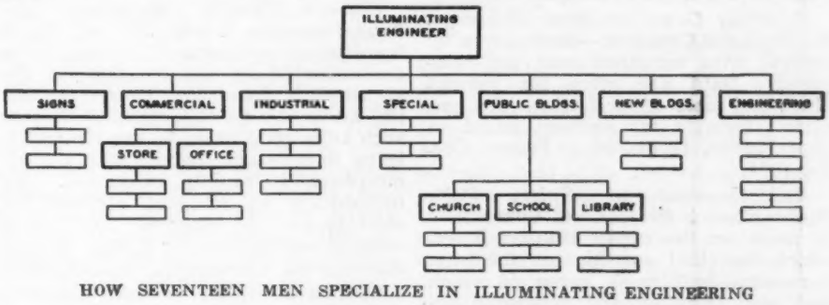
3. The large increases in customers brought about by wiring old houses has opened new fields for the sales of additional load-building appliances and installations. The effect of this is further to increase the load and likewise the company's revenue.

Boston Edison Organization of Lighting Specialists

PROGRESS in the organization of the Boston Edison company's illuminating engineering activities during the past year is shown in the accompanying divisional diagram outlining the functions of the seventeen men now engaged in this branch of load building. Soon after the war the company organized its illuminating engineering service for more intensive development, and the present force is many times in number that at work a few years ago.

The division is a branch of the sales department and is organized into seven subsidiaries. All the men are technical graduates or the equivalent, and it is the company's policy to give these divisional employees special training from time to time by attendance at manufacturers' schools, conventions, N. E. L. A. courses and I. E. S. meetings.

The ultimate plan is to maintain at least one man as a specialist in each branch of the work, but there is sufficient flexibility in the divisional personnel to permit transferring and concentration of forces without losing sales engineering efficiency.



HOW SEVENTEEN MEN SPECIALIZE IN ILLUMINATING ENGINEERING

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Tafjord Power Development in Norway.—A power supply company has been formed to harness the various waterfalls of the Tafjord, near the Norwegian city of Aalesund, which will have ultimately more than 100,000 hp. installed generating capacity, feeding into an extended 100,000-volt, three-phase ring system, the first of this voltage in Norway. At present the bottom-step plant is in operation, with two generating sets of 10,000 hp. each, operating with Francis turbines under a hydraulic head of 490 ft. These wheels drive directly 7,300-kva., 7,000-volt, three-phase, 50-cycle generators, each connected directly to a three-phase transformer with a ratio of 7,000 volts to 113,500 volts. These are butt-joint, circular-coil, core-type machines, specially designed to withstand short circuits. Of particular interest is the high-voltage winding of these transformers, which consists of two parallel sections on each core leg, with the line leads entering in the middle of each coil stack. This is probably the first time this type of high-voltage winding, well established in America, has been used in Europe. Traversing a rugged country with unusually severe climate, the transmission line had to be built very strongly. There are some free spans of from 2,300 ft. to 3,000 ft. The copper conductors of the line have been substituted for bronze wires on these long spans. Of the 20,000-volt distribution lines, 17 miles are laid out as submarine cables in the Atlantic Ocean, supplying a number of small islands.—*Bulletin Oerlikon*, December, 1924.

Selecting Guys for Steel Chimneys. W. WALLACE CHRISTIE.—Rules given by several wire manufacturers are compared. Data are given for various kinds and sizes of steel wire. An empirical formula for anchors, based on experiments, is quoted.—*Power*, Dec. 16, 1924.

Redevelopment of Spiers Falls Hydro-Electric Project.—C. VOETSCH.—A plant on the upper Hudson River, which was laid out for ten 5,000-hp. horizontal-shaft units, seven of which had been installed and generated 40-cycle current, is being rebuilt for 60-cycle service with modern 9,000-hp. vertical-shaft units to operate under 80-ft. head. Construction problems are described. Data on the first unit are given.—*Power*, Dec. 16, 1924.

Selecting Boiler-Feed Pumps.—C. L. HUBBARD.—In this continuation of an article numerical data and curves are given for several kinds of pumps. Their characteristics are discussed.—*Power*, Dec. 23, 1924.

Increasing Boiler Economy by Modern Methods.—HARRY K. BLANNING.—The methods adopted in a 60,000-kw. station to increase the boiler output without additional installation are described. Physical improvements were combined with measures to insure the co-operation of the boiler-room force. Operating averages for twenty months including the transition period are tabulated.—*Power Plant Engineering*, Dec. 15, 1924.

Modern Power-Plant Equipment.—JAMES T. BEARD, 2D.—The various elements and devices are briefly defined and their functions described. Those of which the purpose is specifically to cut or control expenditures are pointed out.—*Industrial Management*, December, 1924.

Generation, Control, Switching and Protection

Multiple-Path Radial Ventilation of Large Turbo-Alternators.—M. D. ROSS.—A system of ventilation for units of the largest size now in construction has been developed which is said to remove any limitation upon the size on that score. In the simple radial system the cooling air under pressure in the end bells is forced into the air gap and is distributed among a number of radial vent ducts in the core, through which it passes to discharge into the outer compartment of the frame. The limitations here are either excessive windage loss due to high velocities in the air-gap section at each end or poor regulation and increase in the size of the machine due to the larger gap. In the multiple-path system the ducts are divided into alternate groups, with inwardly flowing air in some and outwardly flowing air in the others, while in the gap the flow in successive short sections is in opposite directions. Diagrams and tables show the construction, air paths, velocities and temperatures found by test.—*Electric Journal*, December, 1924.

Calcium-Choride Breathers for Transformers.—When the oil in a transformer contracts it is likely to be contaminated by the moisture in the air which is drawn in. To prevent this the air is drawn through a desiccator such as calcium chloride, but the latter, being in constant contact with the atmosphere, is rapidly exhausted. By introducing an oil seal between the chloride and the outer air the former remains serviceable for a long time.—*Engineering* (*England*), Dec. 12, 1924.

Operation of Synchronous Converters at Reduced Voltages.—E. B. SHAND.—For certain conditions of service it is required that synchronous converters be capable of carrying load at greatly reduced voltage. Under these conditions the permissible output is reduced below the normal current values by instability or by excessive heating. The author discusses the internal actions and reviews the design factors involved in non-mathematical language. Results are reported of a test in which it was found that the internal phase displacement rose from 14.5 to 33 electrical degrees and the armature heating increased by 85 per cent when the voltage was reduced to half of normal, with full current output. The conclusion is reached that, for stability, it is important to make the number of commutator bars a minimum, and that in operation at reduced voltage it is possible to reduce the armature copper losses by lowering the field current in order to correct the internal phase angle of the current; but this is done at the expense of the power factor of the system as a whole.—*Electric Journal*, December, 1924.

Transmission, Substations and Distribution

Steel-Aluminum Conductors for High-Voltage Lines.—W. NOBEL.—The author discusses the difference in values for allowable ultimate tension given in American and European catalogs. He investigates theoretically the changes in tension in the steel and in the aluminum conductor due to temperature variation and gives a number of curves.—*Tydschrift voor Electrotechniek*, November and December, 1924.

French Rural Electrification.—H. AMBROSE CARNEY.—The author gives a summary of several of the twenty-nine papers presented at the Lyons congress, dealing in this installment with questions of supply voltages and transmission-line construction and substations. The cost of copper has led to considerable interest in the use of aluminum, copper-clad steel and more recently of a conductor having a steel core coated with zinc over which a comparatively thick coat of copper is forced. This was stated to show a saving of from 40 per cent to 50 per cent on pure copper and to meet all the usual guarantees.—*Electrician* (*England*), Dec. 5, 1924.

Reinforcing Wooden Poles.—I. KRAUTT.—Near the point where wooden poles emerge from the ground rot sets in after a few years and weakens the otherwise sound pole. The author recommends in such cases a cement footing around the buried end of the pole into which are cast two suitably bent pieces of channel iron carried about 6 ft. above ground. A number of heavy bolts hold the pole rigidly between these uprights, and the decayed piece of the pole is sawed off. The result is a wooden pole held about 2 ft. off the ground between two steel channels which are themselves anchored within a solid concrete foundation block. This repair can be made without interruption of service on the line carried by the pole. The excellent rigidity of such poles was established during a sleet storm last year. Most of the ordinary wooden poles collapsed, but the reinforced poles were only slightly bent. For important high-voltage lines the author suggests the use of twin poles erected closely side by side and connected by special steel clamps set about 7 ft. apart. It is claimed that such a twin pole is three times stronger than one of its component poles.—*Elektrotechnik und Maschinenbau*, Dec. 7, 1924.

Standard Specifications for Reinforced-Concrete Poles.—The specifications covered have been drawn up by the committee on concrete and reinforced concrete and on wooden poles of the Canadian Engineering Standards Association. The specifications cover materials, design, manufacture, tests and inspection.—*Report No. C 14—1924, Canadian Engineering Standards Association.*

Units, Measurements and Instruments

Scientific Instruments.—The entire issue is given to the description of new instruments that were shown by twenty-six manufacturers at the exhibition of electrical, optical and other physical apparatus held by the Physical Society of London and the Optical Society on January 7 and 8. Nearly a hundred instruments are described.—*Journal of Scientific Instruments (England)*, December, 1924.

Dielectric Properties of Mica.—D. W. DYE and L. HARTSHORN.—A paper with this title was read before the Physical Society of London on Nov. 14. The results of measurements on more than 170 thin sheets of various kinds of mica were given. They show that practically all samples of muscovite had the same dielectric constant, the most probable value being 7.0. The presence of inclusions had no great effect. For the amber micas the values were lower—about 6.0 for the normal and 5.0 for the silver. Power factors were, for the muscovite as low as 0.0003, clear amber about 0.02 and silver 0.05. Inclusions increased the power factor considerably. Measurements were on samples 8 cm. square and 0.1 mm. thick, with the Garey Foster bridge at 800 cycles.—*Engineering (England)*, Dec. 19, 1924.

Harmonics Due to Slot Openings.—C. A. M. WEBER and F. W. LEE.—This is an abridgment of a paper presented at the spring convention of the A. I. E. E. in Birmingham. The treatment is graphical and analytical. In the original paper this is followed by a mathematical development. The harmonics are found to be multiples of the number of slots per pole plus one and minus one. Their effect in the case of an induction motor, to which this study is primarily directed, is to reduce the low-speed torque.—*A. I. E. E. Journal*, December, 1924.

Illumination

Color Problems. — An abstract is given of a lecture before the Royal Society of Arts by Dr. L. C. Martin. Dates of early attempts and later developments in correcting the energy distribution of artificial light sources are set down. Differences in the requirements for securing satisfactory color effects in window illumination and for color matching are discussed. —*Electrician (England)*, Dec. 5, 1924.

Quality of Russian Lamps.—I. M. RUSSAK.—Comparative tests of incandescent lamps of the Russian manufacturers were made. The tests include: (1) Accuracy of the external shape; (2) consummation of energy per candlepower; (3) deviation of the brightness from the normal; (4) life tests; (5) tests with overload, and (6) mechanical strength. The general results seem to indicate that the Russian lamps are not inferior to those imported.—*Electritchestwo*, No. 5, 1924.

Illumination Meter.—W. BECHSTEIN. —The author describes a portable instrument which gives quickly a direct reading of the intenity of illumination in foot-candles in rooms, halls, shops, etc. The target of the apparatus is a small piece of ground glass divided into two halves. One half receives its light from the measured illumination, while the other part is lighted from within by reflected light of a small battery-operated lamp. The light of this lamp is regulated so that the two halves of the target appear equally luminous. The dimming of the lamp is accomplished by changing the size of the orifice through which the light of the lamp has to pass. An ammeter and a rheostat are included in the instrument to adjust the current through the lamp at always the same amount. The apparatus measures light intensity between 0.01 and 500 foot-candles.—*Zeitschrift des Vereines Deutscher Ingenieure*, Dec. 6, 1924.

Heat Applications and Material Handling

High-Temperature Laboratory Furnace.—W. FEHSE.—The heating element of this furnace consists of a tungsten tube 100 mm. long, 12 mm. in outside diameter and 1 mm. in wall thickness. Heavy water-cooled copper blocks serve as electrodes, of which one is fixed, while the other can move to permit elongation of the heating tube. To observe the heated material a small hole is drilled through the wall of the tungsten tube. The entire arrangement is placed within an air-tight chamber, through which an inert gas, such as nitrogen, is pumped. With an energy of about 8 kw. (7.4 volts and 1,080 amp.) a temperature of 3,000 deg. C. can be readily reached, but the oven has been forced at times up to 3,300 deg.—*Zeitschrift für Technische Physik*, No. 10, 1924.

Coal Handling in Power Stations.—F. J. WARDEN-STEVENS.—This article gives a review of different types of mechanical equipment available for the discharge, transfer to and from storage and delivery of coal to the boiler houses of power stations. These are described in some detail, with illustrations. Data as to size, capacity and speed of handling are given for a number of existing installations in England.—*Electrician (England)*, Dec. 26, 1924.

Direct-Current Hoist and Trolley Control for Ore Bridges.—N. L. MORTENSEN.—This paper presents a comprehensive discussion of ore-bridge control equipment, with circuit diagrams and a large number of charts showing actual duty cycles. The objects of the various types of control, both for hoisting and for the trolley, are set forth in detail. Additional information is contained in the discussion, also reported, following the reading of the paper at a Chicago Section meeting of the Association of Iron and Steel Electrical Engineers in November.—*Iron and Steel Electrical Engineer*, December, 1924.

Telegraphy, Telephony, Radio and Signals

Telephone Repeaters.—C. ROBINSON and R. M. CHAMNEY.—This is an abstract, with diagrams and quite full quotations, of a paper presented before the Institution of Post Office Electrical Engineers reviewing recent research work on transmission phenomena with long loaded repeater cable circuits. The chief of these are distortion due to the variation of line attenuation and repeater gain with frequency, instability due to imperfect balance, transient and echo effects and appreciable time of transmission from end to end. These are taken up in detail and methods are described for overcoming difficulties due to them. To overcome troubles introduced by the relaying equipment for the low-frequency ringer currents a 500-cycle signaling system is advocated. —*Electrician (England)*, Dec. 12, 1924.

The Microphone as a Generator.—P. A. AZBOUKIN.—The insufficiency of the assumption that the microphone acts simply as a variable resistance, thus causing changes in the direct current supplied by the battery, is pointed out. In special cases it is directly shown experimentally that in a circuit consisting of a battery, a resistance and a microphone there is a superposition of two currents—one direct and the other an alternating one. Thus the conclusion is made that the microphone acts as a generator of alternating current. The energy of that alternating current may be supplied by the sound vibrations exciting the microphone, or by the direct current of the battery, which thus is supposed to be partly transformed into alternating current. This assumption is found to be more probable.—*Electritchestwo*, No. 2, 1924.

Telephone Circuit Unbalances.—L. P. FERRIS and R. G. MCCURDY.—In this eight-page abridgment of a Pacific Coast convention paper the requirements as to balance are first reviewed and types of unbalance are classified. Methods are described for determining (1) the general condition of circuits with respect to balance by cross-talk measurements from their terminals, (2) the approximate location of unbalances by bridge measurements over a range of frequencies, and (3) the final location by field measurements with an unbalance detector. Unbalances and appropriate test methods are briefly discussed by the authors.—*A. I. E. E. Journal*, December, 1924.

Study of Coils Wound on Rectangular Frames.—Y. NIWA.—This is a 106-page booklet on the above subject, with particular reference to the calculation of inductances. Former papers by the author have touched mainly on the magnetic field of the single-layer square solenoid and the calculation of inductance of such coils. The author has extended these formulas to coils wound on rectangular frames. Formulas for the calculation of the self-inductance of square coils with rectangular winding section have been derived.—*Research No. 141, Electrotechnical Laboratory, Tokyo, Japan.*

Miscellaneous

Standard Specification for Railway Woven-Wire Fence Material.—The committee on the above subject of the Canadian Engineering Standards Association has drawn up specifications on types of wire fencing and steel gates needed to meet the various requirements of railway service in Canada. The specifications cover manufacture, physical properties, tests for wire, standard classes of fencing, workmanship, packing, marking, inspection and rejection.—*Report No. E-13 (1924), Canadian Engineering Standards Association.*

News of the Industry

For Cabinet Reorganization

American Engineering Council Still Favors Jones-Reavis Bill—Hoover Praises Body

RADICAL changes in governmental departments at Washington were supported by the American Engineering Council, which met in that city on January 16 and 17, and the reorganization bill affecting the Department of the Interior which has the support of the administration was held to be entirely inadequate. The council recommended that the bill conform to the old Jones-Reavis measure originally sponsored by the engineering societies. Among other things the council urged that an Assistant Secretary of Public Architecture be authorized in addition to the proposed Assistant Secretary of Public Works and Assistant Secretary of the Public Domain and that the Board of Engineers for Rivers and Harbors, including the Board of Engineers in New York City, the United States Engineers' Office, the Mississippi River Commission and the California Débris Commission, now under the War Department, be transferred to the Department of the Interior. The personnel would be detailed from the Army Engineer Corps.

Engineers, architects, contractors and allied fields will be enlisted in support of the changes, which, it was announced by the president of the council, ex-Governor James Hartness of Vermont, will be a major task of the engineers of the United States during 1925. The council's committee, headed by Gardner S. Williams of Ann Arbor, will frame definite amendments for the consideration of Congress.

Opposition to Senator Ransdell's pending bill proposing that the Federal Power Commission prepare a comprehensive plan of development of the nation's water resources to promote power development and navigation was expressed in a committee report adopted by the council, the bill being termed not only impracticable in its purposes but burdensome to the commission. It was also held to "suggest a strong entering wedge of government ownership and operation."

HOOVER'S TRIBUTE TO COUNCIL

Secretary Hoover spoke at the annual dinner of the council, asserting that the expenditure of $100,000 by the Department of Commerce in efforts to eliminate waste had resulted in the saving of $600,000,000. "It is a tribute to this organization," he said, "that it should have launched a campaign five years ago that has come to have such a general acceptance and general respect throughout our industries and trades that the Department of Commerce is totally unable to accommodate the demands made upon it for actual time, and today we are asking industries to delay their conferences and their programs for three or four months ahead in order that we may get to them. It is indeed a monument to the value of the American Engineering Council as a contribution to public welfare. If all our brother engineers who have not yet come to our support in this council could be brought to realize that in accomplishment this council has done more for public welfare than our engineering societies have done in the whole period of their existence, we might indeed gain some strength that we so badly need in our immediate support here."

Puget Sound Company to Spend $9,000,000

The Puget Sound Power & Light Company of Seattle, as already announced, has adopted a budget for construction work in 1925 providing for the expenditure of $9,000,000. A large part of this sum will be devoted to the completion of the Baker River project, to cost $6,000,000 and to develop 48,000 hp. This station is to be completed and in operation late in 1925. The 70-mile transmission line required in the development will cost $800,000.

In addition, the company will expend $1,500,000 in improvements to the present distributing system. The largest single item will be the substation at Beverly Park, 3 miles south of Everett, on the line of Pacific Northwest Traction Company. This substation will distribute the power that comes from the Baker River plant to the various cities of the Puget Sound district. It will be of the outdoor type and will step down the voltage from 110,000, which is the potential of the Baker River transmission, to 60,000. The total capacity of the station will be 27,000 kva. and it will cost $450,000. A 13,500-kva. substation will be built at Sedro Woolley, Wash., which will be a switching station for the Baker River power lines and a distribution station where secondary lines at 55,000 volts will branch out to Bellingham and other Puget Sound points. The total cost of this station will be $300,000. In addition to these new projects, the company plans improvements and extensions to all of its properties throughout the Pacific Northwest and is entering upon the most extensive program of construction in its history.

Lower House Delays Underwood Bill

Undecided Whether to Send It to Conference or to Committee on Military Affairs—"Power Trust" Resolution Goes to Interstate Commerce Committee

ACTION on the Underwood bill for the lease of the government properties at Muscle Shoals, sent down from the Senate, was still deferred in the House of Representatives when the ELECTRICAL WORLD went to press. No decision had been reached by the House leaders as to whether it should be sent directly to the conference committee of the two houses or should go first to the committee on military affairs, where previous Muscle Shoals bills were thrashed out. By the latter method the conference committee would be restricted to the adjustment of such differences from the Senate bill as it might contain when finally passed. If the former method is followed, the conference committee, owing to the virtual obliteration of the Ford bill that was passed last session by the House, has it in its power to rewrite the entire legislation.

However, an agreement is now understood to be under way with the Senate managers by which the Upper House will depart from its custom and elect conferees other than the ranking members of the committee having jurisdiction of the bill. This will obviate hostility to it in conference by the Senate members and probably result in its being reported out in a more or less modified form.

The House is now thought to favor the Underwood bill, and if the plan just mentioned is followed and the conference committee acts quickly, it is prophesied that the measure will pass with such amendments as the conference committee may make.

The chief trouble with sending the bill to conference, however, is that to do this either the unanimous consent of the House must be obtained or the House must pass a special rule prescribing a limitation of debate. Each of these methods will be difficult to put into effect, but, all in all, Congressional leaders have strong leanings toward the conference plan.

NORRIS' PROPOSED INVESTIGATION

After having refused to follow its customary procedure of passing promptly resolutions calling for information, the Senate on January 20 referred to its interstate commerce committee the Norris proposal that the Federal Trade Commission secure detailed data concerning the business of power companies. Following extended debate, the Senate accepted an amendment by Senator Norris directing the committee to report on the resolution within six days. Senator Norris had charged that the desire to refer the resolution to the interstate commerce committee was an effort to pigeonhole it. He made another attack on the General Electric Company, quoting from the report of the Lockwood housing committee of the New York Legislature and from Samuel Untermyer in

support of charges of monopoly in the manufacture of electric lamp bulbs sustained by evasion of court decrees. An investigation such as would be authorized by the Norris resolution would cost the public from $1,000,000 to $5,000,000, according to an estimate made by Senator Smoot on data furnished him from several official sources.

Weymouth Station Starts Service

Service into the system of the Edison Electric Illuminating Company of Boston from the new Weymouth station began at 10.28 a.m. January 17, when a short commercial run was inaugurated with the first 375-lb. turbo-generating unit to go into commission. The 1,200-lb. equipment has not yet been installed, but this will probably be done in the late winter or early spring. I. E. Moultrop, assistant superintendent of construction, said on Monday that the plant would probably be placed in regular operation in a few days. Plans are rapidly maturing for the construction of a 110,000-volt transmission trunk line from Weymouth to Walpole and West Medway, involving the erection of new outdoor switching stations and an initial transformer equipment of about 110,000 kva. The first installation at Weymouth comprises two 32,000-kw. units

Rate Reductions in New York Will Save $3,000,000

Based on present consumption, more than $3,000,000 will be saved for users of electricity in New York State during 1925 by rate reductions announced by electric light and power companies which have gone into effect since the first of the year, according to the figures of the State Committee on Public Utility Information. Twenty-four companies, which serve a population of four million people, have lowered their charges for domestic service.

Among the companies which have made such rate reductions are the Buffalo General Electric Company, the Niagara Electric Service Corporation of Niagara Falls, the Brooklyn Edison Company, the Syracuse Lighting Company (in small communities adjacent to Syracuse), the People's Gas and Electric Company of Oswego, the Binghamton Light, Heat & Power Company, the New York Central Electric Corporation (operating in central and Western New York), the Central Hudson Gas & Electric Company (operating in the Hudson Valley between Newburgh and Kingston), the Empire Gas & Electric Company, serving Geneva, Auburn and adjacent territory, and the Long Island Lighting Corporation.

It is estimated that retail lighting customers of the New York & Queens Electric Light & Power Company, numbering approximately 100,000 in the Borough of Queens, New York City, will save approximately $750,000 after March 1, 1925, under an order by the Public Service Commission establishing a schedule fixing the rate at 9 cents per kilowatt-hour with a minimum monthly charge of $1 per month.

Kentucky Executives Meet

Publicity and Education Are Leading Themes—Women Again to the Fore

TWO hundred and fifty-one utility company executives and ninety-eight woman workers in the public utility field attended the eighth annual meeting of the Kentucky Association of Public Utilities, held at Louisville on January 15 and 16, which was one of the best yet held. The part taken by the women was especially noteworthy. Mrs. Florence O. Tate, manager of the investment department of the Kentucky Utilities Company; Miss R. E. McKee, national chairman of the N. E. L. A. women's public information committee; Miss Sophia Malichi, assistant director of the Middle West Utilities Company, and Miss Helen E. Steiner, chairman of the women's public information committee for Ohio and advertising manager for the Ohio Public Service Company, addressed a special meeting exclusively for the women and also spoke, with other women, before the main body of the convention. Miss Frances McDonald of the Louisville Gas & Electric Company was another speaker.

M. S. Sloan, president Brooklyn Edison Company, and J. N. Shannahan, president of the American Electric Railway Association, were prominent speakers.

"I believe," Mr. Sloan said, "that it is the duty of every company to give full publicity to its operations and its policies by furnishing news about its doings and by a liberal use of newspaper advertising. Almost everything a utility does and a good many things it doesn't do affect the public and therefore are legitimate news. The public is entitled to know what we are doing and why, or that we cannot do something and why."

President Pope in his address dwelt on the progress of utility companies in Kentucky, alluded to the importance to the state of the Dix River development of the Kentucky Hydro-Electric Company, now approaching completion, and urged further education of employees, and through them of the public, in utility affairs.

Talks were also made by F. Paul Anderson, dean of the College of Engineering, University of Kentucky, on "What Is an Engineer?"; by Brainard Platt of the Louisville *Courier-Journal* on "The Relation of the Press to Public Utilities"; by Major S. D. Heed, vice-president of the Union Gas & Electric Company of Cincinnati, on "Salesmanship of Public Utility Companies"; by W. H. Hodge of the Byllesby Engineering & Management Corporation of Chicago on "Customer Ownership and Its Effect on Public Relations"; by T. O. Kennedy, vice-president and general manager of the Ohio Public Service Company, Cleveland, on "Serving a Nation"; by Arthur Huntington, Cedar Rapids (Iowa) Railway & Light Company, on "Experimental Farm Electrification," and by others.

The following officers were elected: President, James P. Barnes, president Louisville Railway Company; first vice-president, H. J. Cochrane, president Maysville Public Service Company; second vice-president, T. B. Wilson vice-president and general manager Louisville Gas & Electric Company; secretary, E. F. Kelley, Louisville Railway Company; treasurer, A. A. Tuttle, Kentucky Utilities Company.

Important Hydro-Electric Plant for Connecticut

Work on a new hydro-electric power development at Rainbow, Conn., which will cost about $1,000,000, is to start at once. The Farmington River Power Company, controlled by the Stanley Works of New Britain, plans to develop the Farmington River at Rainbow in the town of Windsor. Most of the power output will be used by the Stanley works. The work includes the building of a dam, power house with two 5,000-kva. units to operate under 60-ft. head, and a 66,000-volt, 20-mile transmission line to New Britain. The engineering contract has been awarded to the Power Construction Engineering Corporation, Worcester, Mass.

Seattle Discards Gorge Creek Plan for Ruby Creek

The City Council of Seattle, Wash., has decided to issue city light bonds aggregating $15,000,000, of which $8,000,000 will be expended in further development of the Skagit at Ruby Creek and $7,000,000 will be used in extension of electric lines, purchase of five substations and for other equipment of the lighting plant. In specifying that $8,000,000 shall be expended in development of the Ruby Creek project, the Council disregarded the plan of Mayor E. J. Brown and Chief Engineer C. F. Uhden of the Skagit project, who recommended that the next development be at the Gorge Creek unit, entailing replacing the crib dam with a masonry dam. The plan adopted calls for construction of a masonry dam at Ruby Creek and an additional unit there.

The development at Ruby Creek will increase the prime power of the Skagit project and is expected to provide between 75,000 hp. and 80,000 hp. the year round. The present Gorge Creek unit provides 56,000 hp. at high water and 23,000 hp. at low water, which is about half the year. The further development at Gorge Creek would have provided approximately 80,000 hp. at high water, with the low-water development remaining the same as at present. The Ruby installation will consist of a storage dam 330 ft. high. It will be 9 miles above the present timber crib dam at George Creek.

The contention of Mayor Brown and Chief Engineer Uhden was that it would take at least seven years to prepare the Ruby dam site and that a permanent dam at Gorge Creek can be built for about $4,500,000, half of what will be needed at Ruby Creek. They favored boring a tunnel through Green Mountain from Cedar Lake to the plant at Cedar Falls and enlarging the capacity of the plant to 40,000 kw. This tunnel would cost $1,000,000, but, engineers have asserted, would obviate building a masonry dam to enlarge the storage of Cedar Lake at a cost of $2,500,000.

S. E. D. Makes Encouraging Reports of 1924 Activities

Enthusiastic indorsement of the business-promotion program carried out by the Society for Electrical Development for the year 1924, the election of Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, to the board of directors of the central station group; the election of 166 new members in all classes, the acceptance of the responsibility of continuing the fostering and development of electrical leagues with the co-operation of the League Council, the formal indorsement of the plan for individual membership in the society and decision to continue and extend the co-operative business development activities for the year 1925 were the main features of the semi-annual meeting of the board of directors of the society held recently.

More than seven hundred newspapers now receive and use regularly the informational articles on electricity and its application sent out by the society. The extent of the co-operative publishing activities of the society was shown by the statement that it published a number of manuals and booklets of which several hundred thousand copies were distributed during 1924. In addition it distributed over 9,900,000 pieces of campaign material for the Lighting Educational Committee, with which body the society co-operated in the organization of the local campaigns and the handling of the detail material. Representatives of the society, acting for the Lighting Educational Committee, traveled more than 60,000 miles in five months.

The electric transportation co-operative development programs were explained in detail. The manufacturers of electric street trucks, batteries and accessories have co-operated in a publicity and field plan for promoting the sale of vehicles. The success of this program has resulted in the organization of a second group in the transportation field, the industrial electric truck and tractor manufacturers, eleven of whom have joined in a similar program. Transportation research in the field of both commercial delivery and industrial material handling are contemplated as a part of the program for 1925.

Committees for San Francisco N. E. L. A. Meeting

Plans for the 1925 convention of the National Electric Light Association, to be held in San Francisco during the week of June 15, have taken definite shape with the announcement of committee personnel by Frank A. Leach, Jr., president of the Pacific Coast Electrical Association.

Franklin T. Griffith, president of the National Electric Light Association and of the Portland Electric Power Company, will be honorary chairman of the general convention committee. Wigginton E. Creed, president of the Pacific Gas & Electric Company, will act as chairman. There will be three vice-chairmen: James B. Black, vice-president and general manager of the Great Western Power Company; J. B. Miller, president of the Southern California Edison Company, and Samuel Kahn, vice-president and general manager of the Western States Gas & Electric Company. C. T. Hutchinson of the McGraw-Hill Company of California will act as secretary of this body, which is made up of thirty-one prominent officials of the N. E. L. A. and executives of central-station companies.

Of the executive committee Frank A. Leach, Jr., is chairman, William Baurhyte vice-chairman and Samuel H. Taylor secretary. Its other members are R. M. Alvord, T. E. Bibbins, J. B. Black, Henry Bostwick, P. M. Downing, R. E. Fisher, Carl Heise, C. T. Hutchinson, A. Jackson Marshall, F. S. Myrtle, J. F. Pollard, M. W. Scanlon, E. O. Shreve and W. G. Vincent, Jr.

Other committee chairman are: Budget, E. O. Shreve; construction and equipment, P. N. Downing; entertainment, R. E. Fisher; hotels, C. E. Heise; personnel and supplies, Henry Bostwick; general transportation, R. M. Alvord; local transportation, W. G. Vincent, Jr.; advertising, M. W. Scanlon; publicity, F. S. Myrtle; local registration, J. F. Pollard; general information, J. B. Black; general reception, T. E. Bibbins.

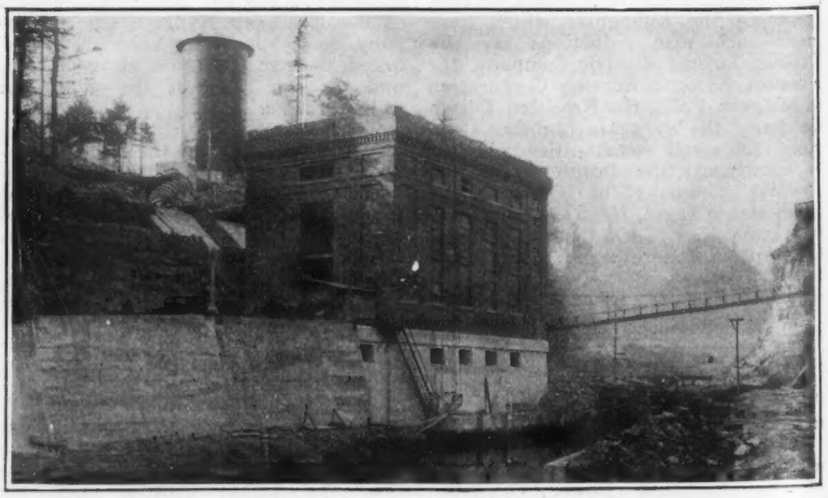
Commission Approves Consolidation and Interconnection

In its fourth annual report, just made, the Public Service Commission of the State of New York declares its approval of the principle underlying the many consolidations of electrical properties to which it gave consent in 1924. In many instances, it says, these have been followed by a reduction in rates and in every instance by an improvement in service. They are a boon to the smaller communities, asserts the commission, which goes on to relate the advantages of interconnection between the larger systems. By this means there is now an unbroken transmission system extending across the state from east to west and into the contiguous states, over which electrical energy could flow did the occasion demand it. The conservation of coal is also made possible by it, especially in the Niagara territory.

"At the present time in the Niagara territory," the report says, "there is a large amount of surplus energy during certain hours of the day, particularly at night, which ought to be used in those sections of the state where steam generation is now continuously employed. The utilization of this energy can be accomplished only by the continuation of the construction of connecting links between the various large systems by means of which an interchange may be effected. While there is a physical connection as stated above between several of the systems, there is a factor which is somewhat of a deterrent to such interchange, namely, the difference in frequency as between the several systems. Niagara energy is generated at 25 cycles, while nearly all of the steam stations and some of the hydro stations are at 60 cycles. It is apparent, therefore, that before the surplus Niagara energy may be employed by the latter frequency changers must be employed. The commission believes that the completion of interchange between the several large systems should be consummated as promptly as practicable, in order that the available power resources within the state may be utilized at their highest efficiency."

The evils of sub-metering, hydro-electric developments and river regulation, the demand for rural service and improved maintenance, with the necessity for state-wide standards of construction, are other points upon which the commission comments.

Beardslee Falls Hydro-Electric Station Starts Up



THE new hydro-electric station of the Adirondack Light & Power Company at Beardslee Falls, N. Y., is now in operation. The illustration shows this station as it looks today with the surge tank and pipe lines in the rear. The height of the surge tank is 70 ft. and its diameter is 34 ft. The diameter of the pipes is 9 ft. This station has two generators each of 15,000-hp. rating, and with the present dam development it has a capacity of 20,000 hp. The original course of the stream was through the ravine.

Opposite Methods at Niagara Discussed

Wyer Contrasts the Plan of the Government-Owned Hydro System of Ontario with Private Operation on This Side of the Border

THE survey of the power possibilities of Niagara Falls made by Samuel S. Wyer of the Smithsonian Institution and issued with the indorsement of that body and an introduction by Dr. Charles D. Walcott, its secretary, was quoted from in the ELECTRICAL WORLD for January 17, page 161, in connection with a news article on the need expressed on both sides of the international boundary for more power from Niagara Falls. Mr. Wyer did not confine his investigation to the engineering aspects of the situation, but entered at some length into a discussion of the contrasting methods of utilization in the United States and Canada, contending that a number of fallacies underlie the assumption that the government-supplied energy in Ontario is cheaper, everything considered, than the private supply in New York State. On this point the pamphlet said:

"The Niagara River is more than a mere boundary stream between two friendly nations. It is the dividing line between two radically different methods of rendering electric service to the public. In Ontario the plants are owned by the government. In the United States the plants are owned privately but regulated by the government. These fundamentally distinct methods have a definite and far-reaching effect on the economic structures of the two nations, thus:

"1. In Ontario the governmentally owned system sells electric service to domestic consumers at rates considerably below those prevailing in the United States, because: (a) Governmentally owned property is exempt from taxation. This means a gain to the electric consumer of about 10 per cent, with, however, a corresponding loss to the taxpayers, as compared with conditions in the United States. (b) The domestic electric rates are below cost and the loss is made up in part by higher rates for power consumers than prevail in the United States, which places Canadian industry at a disadvantage. (c) Part of the cost comes directly out of the provincial treasury in the form of contributions and subsidies. (d) Part of the cost has been delayed by not making provision for an adequate sinking fund to retire the bonds as they mature, thus placing the burden on a future group of consumers or on the public generally to be met out of general taxation of the entire province.

"2. In the United States the privately owned but governmentally regulated systems sell electric service to domestic consumers at rates higher than those prevailing in Ontario because: (a) Since the property is taxed the tax comes from the consumer, and this alone makes a difference of about 10 per cent over and above the average cost that would prevail if the properties were tax-free as in Ontario. In the United States the electric power utilities paid approximately $135,000,000 in local, state and federal taxes in 1923. (b) Under the scheme of governmental regulation in the United States the rates correspond substantially to the cost of the service. The domestic consumer's cost per kilowatt-hour is more than the industrial consumer's. This, of course, means that the domestic rate per kilowatt-hour is higher than the industrial, but it also results in giving the United States industrial consumers lower rates than the industrial consumers in Canada, thus giving United States manufacturers an advantage over Canadian manufacturers. (c) Under the scheme of governmental regulation in the United States the capital invested is not retired, and frequently bonds are refunded. However, the income received from the public in any normal plant provides for at all times maintaining the integrity of the property value. There are no contributions from the public treasury at present or any obligations that must be met out of the public treasury in the future. That is, the United States governmentally regulated method is based on the principle of 'pay as you go' without any deferred debt for the future."

OPPOSITE RATE-MAKING PRINCIPLES

Regarding the opposite situations in rate making, Mr. Wyer remarks: "The major part of the cost of generating electrical energy is fixed and accrues regardless of the output of the plant. This arises from the large amount of capital that is necessary to rent or hire just to get ready to start, and the then inevitable large capital hire or rental resulting from continuing to stand ready to serve for each of the 8,760 hours of the year. Therefore, the greater the number of average kilowatt-hours that energy is used, the smaller will be the fixed charge that will be prorated on each kilowatt-hour. That is, increase in hours' use decreases the cost per hour.

"The domestic consumer uses energy but a short time each day, while the average industrial consumer is a long-hour user. Therefore the cost per kilowatt-hour of industrial energy is less than for the domestic energy.

"The dominating fundamental principle of rate charging in the United States—approved by the state regulating commissions—is to make each group of consumers self-sustaining and pay for the cost of the service they are receiving; that is, not to carry one group at the expense of some other group. This means that the short-hour domestic consumer must pay a higher rate than the longer-hour and greater-quantity-using industrial consumer.

"The Ontario method is diametrically opposite. Here the short-hour domestic consumer is arbitrarily, and without regard to the cost situation, given a lower rate than the cost situation would warrant. The loss is made up by other consumers. The Ontario domestic consumers, therefore, are carried at the expense of other consumers."

On the subject of tax exemption of the publicly owned Canadian system Mr. Wyer has this to say: "The governmentally owned hydro-electric system supplying 79 per cent of the service in Ontario is not taxed. This exemption from taxation, of course, results in lowering the cost of power to the consumer. However, the gain to the consumer in lower rates is equaled by the loss to the taxpayers of the taxing districts in which the property is located.

"The private property of the Canadian Niagara Falls Company at Niagara Falls pays local taxes in Stamford Township equivalent to 76 cents per horsepower capacity. If this same rate were paid by the 660,000-hp. governmentally owned equipment located almost entirely in Stamford Township, it would produce local taxes of $501,600. The total annual taxes levied by Stamford Township are $252,000. The privately owned plants at Niagara Falls on the Canadian and United States sides in 1913, with an income of $7,121,928, paid taxes aggregating $1,392,000. For the entire United States about 10 per cent of the dollar the public pays for electric service goes for taxes.

"The Hydro-Electric Power Commission in the past has spent a large amount of money in giving engineering assistance, preparing estimates, making general surveys and rendering electrical inspection service to various municipalities. This has all been paid directly out of the provincial treasury and in no way charged against the governmentally owned operations."

Under the heading "Dodging Sinking-Fund Facts," Mr. Wyer makes these observations: "When the Ontario governmentally owned hydro-electric system was initiated the hope was held out to the public that the income from electric consumers would pay off the bonds. This has not been accomplished. Contribution to the sinking fund necessary ultimately to retire the bonds, which should have been started at the beginning of operation, has been deferred from five to fifteen years, thus placing on a future group of consumers the burden of return of money used by present consumers. If the money to retire the bonds is not provided for in the rates charged for electric service, it must ultimately come out of the provincial treasury as payment of the bonds has been guaranteed by the Province of Ontario. In the United States the plants must stand on their own feet and there can be no demand on a public treasury."

HYDRO'S FINANCING METHODS

After remarking that the Ontario system's operations—up to the town distributing plants, which are owned by the local municipalities—have been financed by two classes of securities, Mr. Wyer supplies these statistics:

"On October 31, 1924, the outstanding bonds of the Hydro-Electric Power Commission amounted to $41,768,523. These bonds range in life from ten to forty years. If the electric consumers —as originally contemplated in the slogan-made public opinion of 'service at cost'—had been charged an annual sinking-fund allowance each year which

would ultimately retire the bonds out of electric earnings when they mature —on the basis of a 4 per cent sinking fund compounded annually — there should have been on hand at the end of 1924 in the sinking fund to retire these bonds $9,579,107. The accumulated fund actually paid out of rates charged electric consumers to October 31, 1924, was $1,829,461. The shortage existing in the sinking fund is, therefore $7,749,646.

"On October 31, 1924, the total advances to the Hydro-Electric Power Commission out of the provincial treasury, separate and distinct from the Hydro bonds mentioned above, amounted to $138,454,638. This money is supposed to be returned at the end of thirty years. If the electric consumers —as originally contemplated—had been charged an annual sinking-fund allowance each year which would ultimately pay back this money out of electric earnings at the end of thirty years— on the basis of a 4 per cent sinking fund compounded annually — there should have been on hand at the end of 1924 in the sinking fund to retire these borrowings from the provincial treasury $11,859,541. The accumulated sinking fund actually paid out of rates charged electric consumers to October 31, 1924, was $3,902,495. The shortage in sinking fund is, therefore, $7,-957,046."

In other words, according to the Smithsonian Institution's survey, future consumers of power furnished by the Ontario governmentally operated electric system must raise $15,706,692 in order to pay for the low-priced service that past consumers have received. The alternative is to take the amount from the provincial treasury; that is, the taxpayers.

In summarizing, Mr. Wyer remarks that the Ontario system has failed to pay expenses because money was taken from the provincial treasury instead of from earnings for the following purposes: Subsidizing rural lines, $1,194,-422; general expenses, $2,245,900; Hydro-Electric Commission bonds, $7,-749,646, and money borrowings from the provincial treasury, $7,957,046, a total of $19,147,014.

SAVING THE HORSESHOE FALLS

Mr. Wyer's study, which is entitled "Niagara Falls: Its Power Possibilities and Preservation," also contains allusions to the Chicago Drainage Canal diversion, and it is pointed out that the water Chicago is at present asking for (10,000 cu.ft. per second) is just about equal to the amount of water going over the American Falls at Niagara Falls.

The Canadian side of Niagara Falls —carrying 94 per cent of the water—is rapidly, by nature's own means, destroying itself, it is said, and non-use of the water is not preservation. The only way to save the Canadian Falls is to prevent the concentration of the water in the V-shaped notch at the center by constructing artificial islands or a submerged dike above the Falls, so as to provide a redistribution of the flow. Real preservation can be brought about only by frankly facing the engineering and geologic facts now obvious and the development of an international preservation program that will insure maximum use with the continued preservation of an adequate scenic effect.

Canadian Officials Contradict Wyer's Contentions

Premier Howard Ferguson of Ontario and Sir Adam Beck, chairman of the Hydro-Electric Power Commission of that province, are quoted in Canada as both declaring that the provincially owned Hydro system is and will continue to be a paying investment, despite the argument made by S. S. Wyer of the Smithsonian Institution to the effect that the system is in reality losing money. Premier Ferguson asserts that the independent auditors' report corroborates and affirms the Hydro statements that all interest payments are being met and a sinking fund provided much sooner than had been expected. Sir Adam is reported as saying that Mr. Wyer has distorted facts and figures supplied him by the commission.

Premier Ferguson has also gone on record as opposed to the exportation of hydro-electricity from Ontario, on the ground that the province needs all it can produce, thus coming to the support of Premier Taschereau of Quebec, whose views were given in "News of the Industry" last week. On the disputed question of provincial and Dominion jurisdiction T. A. Low, federal Minister of Trade and Commerce in Canada, said: "The water powers, being natural resources, belong to the provinces, but the right of regulating the export comes under this department. The licenses are annual and can be revoked, but difficulties and hardships may arise if a supply once furnished to industries across the line is suddenly cut off." Mr. Low intimated that the whole matter is under consideration of the Dominion Cabinet.

Interconnection with Washington-Idaho Lines

Following confirmation by the court of the sale of the properties of the Washington-Idaho Water, Light & Power Company, Lewiston, Idaho, to L. B. Hatch of New York, announcement is made that this property has been transferred to the Inland Power & Light Company and will be operated by the Pacific Power & Light Company, Portland, Ore. The Lewiston property, which was bought for $1,125,000, consists of the light and power business in Lewiston and Lapwai, Idaho, and Clarkston and Asotin, Wash., supplied by two hydro-electric generating stations on Asotin Creek, one of 1,500-kw. and the other of 400-kw. capacity, with a 22,000-volt transmission line connecting the four towns. A further source of supply is furnished through a connection with the Washington Water Power Company, Spokane, Wash., over a line north to Moscow, Idaho.

The Pacific Power & Light Company has commenced surveying a right of way for a 66,000-volt line from Pomeroy, Wash., to Lewiston, a distance of about 30 miles, which will connect the new property to the Yakima-Walla Walla power system of that company.

Briefer News

Iowa Southern Takes Over Properties.—Transfer of the properties of the Burlington Railway & Light Company, the People's Gas & Electric Company and other interests held by the Walsh brothers to the Iowa Southern Utilities Corporation has been effected. The consideration was, it is said, nearly four million dollars.

Rocky Mountain League Elects Officers.—C. B. Hawley, vice-president and general manager of the Inter-Mountain Electric Company, Salt Lake City, has been elected president of the Rocky Mountain Electrical Co-operative League. George R. Randall, president and general manager of the Salt Lake Electric Supply Company, was elected vice-president, and R. M. Bleak was re-elected secretary-treasurer.

Institute Members Called in Conference by War Department.—At the conference with engineers called by the War Department last week to discuss the construction policy of the department, the American Institute of Electrical Engineers was represented by N. A. Carle, Public Service Production Company; Prof. C. A. Adams, Harvard University; E. W. Rice, General Electric Company; H. W. Eales, Union Electric Light & Power Company, St. Louis, and J. H. Finney, Aluminum Company of America.

New York Lighting Companies to Study Eclipse.—At the request of scientific societies the New York Edison Company and its associated companies in the metropolitan district have agreed to station ninety lighting experts and photographers on the roofs of substations and tall apartment buildings this morning (Saturday) to study the total eclipse of the sun. They will attempt to locate exactly the southern border of the moon's shadow as it swiftly crosses the city—a point on which exact calculations largely depend.

Puget Sound's New Million-Dollar Plant Goes Into Service. — The new 20,000-hp. plant of the Puget Sound Power & Light Company at Dieringer, Wash., which cost $1,000,000, was formally placed in operation on January 1. With this installation the White River plant at Dieringer will have a capacity of approximately 80,000 hp., making it the largest in the Northwest. The company also announces that every effort is being made to rush to completion the first 60,000-hp. unit on the Baker River site in Skagit County, so as to have that plant in operation by January 1, 1926.

Byllesby & Company Purchase Tillamook (Ore.) Central Station.—H. M. Byllesby & Company announced last week that they had purchased the Coast Power Company, which serves a territory extending 30 miles along the Pacific Coast in Tillamook County, Ore., including dairying, lumbering and fish-packing sections. Electrical energy is supplied to the towns of Tillamook, Bay

City, Garibaldi, Rockaway, Brighton, Bar View, Wheeler and Nehalem. There are 200 miles of line. The newly acquired company, it is understood, will be operated as a division of the Mountain States Power Company of Albany, Ore., an operated utility of the Standard Gas & Electric Company.

Iowa Companies to Spend Many Millions in 1925. — Contemplated extensions and improvements in electric and gas industries in Iowa for 1925 will exceed $50,000,000, the amount expended during 1924, according to figures compiled by the Iowa Committee on Public Utilities. Included are expenditures on the three great central stations under construction at Des Moines, Davenport and Sioux City.

Power Corporation of New York to Build Another Hydro-Electric Plant.—A new hydro-electric plant at Deferiet, on the Black River, New York State, is to be started as soon as the high water is over in the spring by the Power Corporation of New York, according to its president, John N. Carlisle, and will be completed before the end of the year. It will contain three 5,000-kva. turbo-generators, and most of the power will be used in the mill of the St. Regis Paper Company.

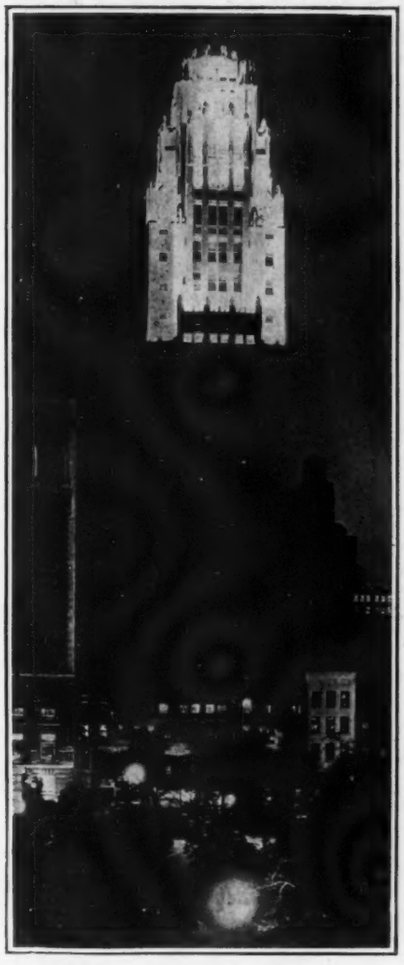
Ontario Hydro Seeks Higher Rates in Ottawa.—Opposition has arisen in Ottawa, Canada, to an effort on the part of the Ontario Hydro-Electric Power Commission to file a higher schedule of rates, involving an average increase of 15 to 20 per cent, with the Ottawa Hydro Commission. At a recent meeting the City Council unanimously went on record as being opposed to any increases and instructed the Mayor of the city to oppose them.

Oregon Public Service Commission Adopts N. E. L. A. Classification of Accounts.—At a public meeting held by the Public Service Commission of Oregon on December 18, 1924, at Portland, it was announced that, beginning January 1, 1925, all utilities in the state would be required to keep their accounts in accordance with the system adopted by the National Association of Railway and Utilities Commissioners. This system is virtually identical with that recommended by the N. E. L. A. in so far as it applies to electric light and power companies. Oregon is one of the last states to adopt this system.

Manitowoc Protests Against Reduced Rates.—The city utility commission of Manitowoc, Wis., has made a vigorous protest against the action of the Wisconsin Railroad Commission in reducing the rates charged by the municipal lighting plant 20 per cent. The city asserts that this reduction will leave it without sufficient reserve for future construction and also maintains that its rates are lower than those charged in most cities of Wisconsin and nearly 25 per cent lower than the rates charged by a competing private company. The commission's order was based on figures showing gross receipts of about $236,000 and expenses of about $115,000. The city's present rates for lighting are on a sliding scale of 8 cents to 5 cents and for power 5 cents to 1 cent.

Consolidation of Eastern Maine Utilities Sought.—Electric utility companies whose management centers in the Bangor-Bar Harbor district of Maine were heard last week before the Public Utilities Commission of that state upon a petition to allow the Bangor Railway & Electric Company and the Bar Harbor & Union River Power Company to consolidate their franchises with those of the Lincoln Light & Power Company and the Bangor Hydro-Electric Company. These utilities are under the general management of E. W. Clark & Company, Philadelphia, and the proposed consolidation is chiefly for corporate economies. Edward M. Graham is president of the Bangor Railway & Electric Company.

Electricity Adds Night Brilliance to Bold Architecture



ONE of the most striking office structures in New York City is the new black and gold building of the American Radiator Company at 40 West Fortieth Street, near the Public Library. This building has taken on new brilliance at night through a floodlighting installation recently completed.

The towering mass is now lighted by fifty-six General Electric incandescent floodlighting projectors placed at strategic points from the twenty-first floor to the roof of the twenty-four-story building, all these lights being under the control of the watchman by means of a remote-control switch in the main hall on the ground floor. Eight projectors of 1,000 watts each are installed at the twenty-first floor, sixteen 500-watt lights at the twenty-second, twenty-four 500-watt projectors at the twenty-fourth floor and eight 1,000-watt units on the roof. The installation was made under the direction of Bassett Jones.

Hamilton, Ohio, to Rebuild Its Transmission System.—Notwithstanding that Hamilton, Ohio, is in bad financial plight and unable to finance properly its municipal departments, the distribution system of the city's lighting plant is to be rebuilt this year at a cost of $100,000 as an outcome of the authorization by the voters last fall of the reconstruction of the plant, which was the alternative to the acceptance of an offer from the Union Gas & Electric Company of Cleveland to buy the plant for about $500,000 and extend and improve it. The Union Gas & Electric took over the private central station of the city a year or more ago. Bonds for $600,000 to carry out the program indorsed by the voters have been issued by the city.

Stone & Webster to Manage Western United Corporation Properties.—Announcement was made this week that Stone & Webster, Inc., have been retained as executive managers of the properties owned by the Western United Corporation, consisting of gas, electric light and street-railway companies supplying service in eighty-seven communities in Illinois, including Aurora, Elgin, Elmhurst, La Grange, Joliet, Marion and Murphysboro. Gross earnings of the group last year were approximately $6,000,000. The consolidation of the companies of the Western United Corporation has been brought about by Ira C. Copley, who is the president of the Western United Gas & Electric Company of Aurora and the Southern Illinois Gas Company (supplying electricity) of Murphysboro.

Hydro-Electric Power for Mississippi Coast.—Another progressive step has been taken in the acquirement of the Gulfport & Mississippi Coast Traction Company, the Bay St. Louis Electric Company and the Lumberton Electric Company by the Mississippi Power Company, which is affiliated with the Alabama Power Company. The purchase of other Mississippi plants, the Louisiana - Mississippi Committee on Public Utility Information says, is expected soon. In a statement recently given out, Barney E. Eaton, president of the Mississippi Power Company, said that more than $15,000,000 will be spent in improvements in Mississippi and that engineers and surveying parties are now at work on routes connecting the coast and other points in Mississippi with power plants in Alabama.

New Connection Between Washington and Oregon Lines.—A second connection between the systems of the Washington Water Power Company, Spokane, Wash., and the Pacific Power & Light Company, Portland, Ore., in central Washington, is contemplated in

the 110,000-volt transmission line projected by the latter company between Hanford and Taunton. This line, which will be 6 miles long, has been surveyed, and the right-of-way for it has been acquired. It is expected that the line will be completed in the early spring. In connection with this tie-in a bank of three 3,000-kw., 110,000/66,000-volt, single-phase G. E. transformers will be installed at Hanford, duplicating the present installation at Lind, Wash., which has heretofore been the single connecting point between the systems of the two companies supplying energy to the Pacific Power & Light Company's Yakima-Walla Walla power system at Pasco, Wash.

Tennessee Electric Power May Start Ocoee No. 3 Plant.—Construction work on the power development of the Tennessee Electric Power Company to be known as Ocoee No. 3 and on its Morganton reservoir may be started in 1925, according to a statement from Vice-president Edgar. The reservoir and the third Ocoee plant will represent an expenditure of about $6,000,000, each costing approximately $3,000,000. The Toccoa (Morganton) river development will include a single-unit hydro-electric plant with a capacity of from about 15,000 hp. to 18,000 hp. The third Ocoee plant will have a rated capacity of about 30,000 hp. The two projects will thus increase hydro-electric generation by about 48,000 hp. The main idea underlying the erection of the reservoir is to regulate the flow of the water through the two present Ocoee plants and the third proposed plant, thereby increasing the period of time each year that these plants can be operated at their maximum capacity.

Expansion of Foshay System in Minnesota and Other States.—The W. B. Foshay Company of Minneapolis has completed arrangements to take over the People's Light & Power Company, which serves nineteen communities in southwestern Minnesota, in the vicinity of Wilmont, Lamberton and Westbrook. The People's company, in its turn, is taking over the plants and transmission systems which serve the towns of Fulda and Mountain Lake, Minn., thereby adding these properties to those controlled by the Foshay organization. With this new purchase, as explained by President W. B. Foshay, his company controls four utilities supplying electric light and power to 126 communities and nearly 700 farms in Minnesota, Iowa, South Dakota and Nebraska. These properties, which are valued in excess of $3,500,000, are the Minnesota Electric Distributing Company, operating in southwestern Minnesota; the Tri-State Utilities Company, serving South Dakota, Iowa and Nebraska; the Iowa River Light & Power Company, operating in Iowa, and the People's Light & Power Company, just acquired. Mr. Foshay also announces plans to expand the service facilities of the Foshay companies by immediate construction of a high-tension line to connect the Minnesota Electric Distributing Company with the People's company. The transmission line of the Foshay companies already extends from Sioux Falls, S. D., to Wilmont, Minn.

All Wynooche Filings Canceled.—With the city of Aberdeen, Wash., and the Gray's Harbor Railway & Light Company still fighting for water rights on the Wynooche River in Gray's Harbor County, the state Division of Hydraulics has taken action to cancel all permits and filings on the stream and make a fresh start possible. J. E. Malinowski, upon whose permit the city's application was based, has sixty days in which to show cause why the permit should not be void for failure to comply with statutory requirements as to development. Notice of cancellation of applications was also transmitted to the city of Aberdeen and to the Gray's Harbor Railway & Light Company. It will be remembered that a two-million-dollar bond issue voted for the proposed municipal project on the Wynooche was upset in the courts.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Western Association of Electrical Inspectors — Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 28-30. H. M. Northrup, 23 Erie St., Milwaukee.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, Feb. 5-6. J. N. Cadby, 443 Washington Bldg., Madison, Wis.

New Mexico Electrical Association—Albuquerque, N. M., Feb. 16-18. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

American Institute of Electrical Engineers—New York, Feb. 9-12; St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 16-19. F. F. Sharpless, 29 West 39th St., New York.

Wisconsin Chapter of Electrical Inspectors—Pfister Hotel, Milwaukee, Feb. 17-19. A. C. Schultz, Milwaukee.

American Physical Society—New York City, Feb. 27-28; Pasadena, Cal., March 7.

Illinois State Electric Association—Hotel Sherman, Chicago, March 18-19. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

American Institute of Electrical Engineers, — Regional conventions, Swampscott, Mass., May 7-9; Cleveland, May 22-23.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. H. M. Davis, Fraternity Building, Lincoln, Neb.

Electric Power Club—Hot Springs, Va., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association —Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Southern Canada Power Adding Eight Units.—In its annual report the Southern Canada Power Company points out that the system has been extended to serve St. Blaise and South Durham, Quebec. The municipal light and power plant of Bedford was turned over to the company, and a line is under construction from Cowansville to Bedford. A new transmission line from Richelieu to St. Johns has been completed and is now in operation. Substation capacities have been increased, and the existing distribution plants have been extended to provide for the 16,217 customers which the company was serving at the close of the fiscal year. The work on the new hydro-electric plant at Hemmings Falls has progressed satisfactorily. Two of the six 5,000-hp. units in this plant are expected to be ready for operation in January, and the other four units are expected to be ready for operation in the late fall of 1925. Contracts have been awarded for two additional 6,000-hp. units for the Drummondville plant, which will bring the capacity of this plant up to 18,000 hp.

Farm Experts Meet to Hear About Garner Experimental Plan. — Thirteen states were represented at a conference held at the Iowa State College at Ames recently to discuss the electrification of farms. This conference marked the opening at Garner, Iowa, of what is expected to be one of the most effective electrical experiment stations in the country. The Iowa State College is directing the work, which has been described briefly in previous issues of the ELECTRICAL WORLD, and Prof. Frank D. Paine of the electrical engineering department is in charge as supervisor. Franklin K. Zink, an agricultural engineer, will conduct the experimental work in co-operation with sixty-nine farmers. Miss Eloise Davidson will be in charge of household mechanics. J. B. Davidson, professor of agricultural engineering, will assist in an advisory capacity, and other members of the faculty will co-operate. Speakers at the conference were E. A. Stewart of Minnesota, R. L. Patty of South Dakota, E. W. Lehmann of Illinois, T. E. Heinton of Indiana, E. E. Bracket of Nebraska and H. B. Walker of Kansas, all connected with similar undertakings; John W. Coverdale, Dr. E. A. White and Arthur Huntington of the national committee; G. C. Neff, chairman of the rural electric service committee of the N. E. L. A.; President Pearson of Ames College, E. A. Holloway of Cedar Rapids, Edward Quintus, chairman of the Garner farmers' committee, and Supervisor Paine. The formal name of the station will be "Iowa's Rural Community for Electrical Development." Charles E. Hearst, who is president of the Iowa Farm Bureau Federation, is chairman of the Iowa state committee, and J. B. Davidson is chairman of the Iowa State College committee.

Men of the Industry

W. S. Gifford New President of A. T. & T.

Walter S. Gifford, for the past two years executive vice-president of the American Telephone & Telegraph Company, has been elected president of the company to succeed Harry B. Thayer, who becomes chairman. Mr. Gifford, a native of Salem, Mass., has been affiliated with the Bell Telephone system since his graduation from Harvard in 1905. Joining the staff of the Western Electric Company at Chicago as a

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W. S. GIFFORD

clerk in the payroll department, he later became assistant secretary-treasurer of the company at New York, in charge of the accounting in the New York factory and Eastern distributing houses. In 1908 he became statistician of the American Telephone & Telegraph Company, the parent of the Western, and under his direction was developed the present famous statistical department, probably the largest in the country. During the war he obtained a leave of absence to serve as director of the Council of National Defense and upon his return was appointed comptroller of the company. A year later he was made a vice-president in charge of finance and accounting and in 1923 was chosen executive vice-president. This office, created at the time for Mr. Gifford, will not be filled.

The office of chairman, to which H. B Thayer has been elevated, is a new one, and the promotion comes to Mr. Thayer after an association with the system covering forty-four years. Entering upon his business career in a bank, he later joined the Western Electric Company at Chicago and subsequently was made manager of the company's business in New York. In 1909 he was elected vice-president of the American Telephone & Telegraph Company and in 1919 became its president.

James J. Kirk, for the past twelve years illuminating engineer of the Commonwealth Edison Company, has resigned to become manager of the branch recently opened by the Pittsburgh Reflector Company in Chicago. In addition to being illuminating engineer Mr. Kirk also handled the lighting sales work of Commonwealth Edison.

Marion Penn, formerly chief engineer of the Public Service Electric & Gas Company's Marion station, Jersey City, has been appointed chief engineer of the company's new superpower station in Kearny.

Harley W. Brundige has been elected president of the Railroad Commission of California to succeed Commissioner Clyde L. Seavey, who has held that position for the last two years. The present election marks Mr. Brundige's second term as head of the commission, he having been selected to succeed Frank R. Devlin about three years ago.

L. C. Datz Leaves Memphis

L. C. Datz has resigned as chief engineer of the Memphis Power & Light Company to become affiliated with the firm of Newman Saunders & Company in the reorganization of public utility properties in the Middle West. He will make his headquarters in St. Louis.

In 1903 he started in public utility work with the New Orleans Railway & Light Company. In 1911 he became connected with Ford, Bacon & Davis as assistant engineer, and a year later, when the American Cities Company was organized by Ford, Bacon & Davis and the New Orleans Railway & Light Company became a part of this group of Southern properties, he returned to the New Orleans company as engineer of maintenance of way, engineer of roadway and then chief engineer of the system. In 1914, when the United Gas & Electric Engineering Corporation established an office in the South, he became engineer of Southern properties, having engineering supervision of public utility properties in New Orleans, Houston, Birmingham, Memphis, Knoxville and Little Rock. He resigned as vice-president of this corporation in 1919 to become chief engineer of the American Cities Company, which at that time formed an organization of its own to supervise its properties. He served in this office until April, 1922, when the American Cities Company was taken over by the National Power & Light Company, at which time he went to Memphis, Tenn., to become chief engineer of the Memphis

L. C. DATZ

Gas & Electric Company and chief engineer of the Little Rock Railway & Electric Company. When the Memphis Power & Light Company was organized on January 1, 1923, Mr. Datz became chief engineer.

Obituary

Everett W. Burdett, formerly general counsel of the National Electric Light Association and for many years secretary of the Massachusetts Electric Lighting Association and general counsel of the Edison Electric Illuminating Company of Boston, died at his home in Boston January 18, after a notable career. Mr. Burdett was born in Mississippi in 1854 and at the time of his death was senior member of the firm of Burdett, Wardwell & McLeod, Boston. He was the author of many addresses and papers upon public utility regulation and was a lifelong champion of private ownership, in the interest of which he had traveled extensively abroad. He retired from active connection with the Boston Edison company a few years ago.

Minard L. Holman, retired engineer and past-president of the American Society of Mechanical Engineers, died on January 4 at his home in St. Louis. Mr. Holman was a native of Maine and a graduate of Washington University. Some years ago he spent five years with the Missouri Edison Electric Company in the capacity of general superintendent, after resigning as Commissioner of the St. Louis Water Works, with which he had been identified since 1877. In 1904 he beeame senior member of the firm of Holman & Laird, consulting engineers of St. Louis. Mr. Holman was actively interested in the American Society of Mechanical Engineers, serving as vice-president in 1894-1896 and 1903-1905 and as president in 1908-1909.

Glenn Grenville Howe, for many years senior vice-president of the Link-Belt Company, Chicago, died at his home in Muskegon, Mich., December 24 after a long illness. His first connection with the Link-Belt organization was as an office boy in 1877. Following his mechanical bent he drifted into the manufacturing department and later became the superintendent of the Ewart Manufacturing Company. When the three related interests, the Ewart Manufacturing Company, the Link-Belt Machinery Company and the Link-Belt Engineering Company, were merged into one as the Link-Belt Company in 1906, Mr. Howe became vice-president, in charge of the company's Indianapolis operations. About the end of 1923 he was stricken with the illness which finally resulted in his death. He was sixty-three years of age.

Commission Rulings

Return on Leased Property for Which Only Nominal Rent Is Paid.—A claim for a return on the value of an electric line leased from another company was disposed of by the California Railroad Commission in adjudicating a complaint made by the Napa County Farm Bureau against the Napa Valley Electric Company. The commission said: "In certain previous cases the commission has included in operating expenses or in the fair return a reasonable rental paid for leased property and has judged the fairness of the rental by comparison with the cost of the property leased. In these instances, however, we were considering a bona-fide lease of valuable property, while in the present case only a nominal rent is paid. The evidence in this and in previous matters before the commission shows that the lease under consideration may be terminated on short notice and is in practical effect a revocable permit for the use of the line free of charge. The same claim has previously been disallowed and no good cause appears for any change in policy at the present time."

Equity of Readiness-to-Serve Charge.—The readiness-to-serve charge in connection with public utility services results in a more equitable distribution of the cost of providing service, according to a decision of the Ohio Public Utilities Commission made in allowing a monthly service charge to the Ashtabula Gas Company. The commission said: "There is much to be said in favor of a readiness-to-serve charge, and it has been recognized by commissions and courts of several states. Experience has shown it is not the poorer class who usually demand the connection and then fail to use the service, but the well-to-do, who have other means of supply and desire the connection only that they may be prepared for emergencies. There is a certain amount which the public must pay to enable the utility to operate. If a portion of it is paid in a readiness-to-serve charge, that much less is necessary to be produced from the sale of gas. The readiness-to-serve charge does not yield the company any greater sum nor cost the consumer any more money. It results only in a different distribution of the burden. It would seem that any one demanding the service should pay at least a sum equal to a fair rate of interest on the 'bare bones' of the investment, whether he uses any gas or not."

Distribution of Demand Costs—Special Group Contract Not Necessarily Discriminatory—In discussing complaints made against the rates of the Lehigh Navigation Electric Company and the Lehigh Valley Light & Power Company (now merged in the Pennsylvania Power & Light Company), the Public Service Commission of Pennsylvania laid down the two following among other principles: (1) A distribution of demand costs resting squarely upon the ratio of the demand of a customer at the time of the peak load on the system to that peak load furnishes a truer basis for testing the reasonableness of power rates than an apportionment of demand costs on the basis of the ratio of a customer's maximum demand to the sum of the individual maximum demands of all the customers, regardless of the time when they occur, rejecting any recognition of offpeak service as being entitled to freedom from or reduction in demand costs, and resting solely and squarely upon ratios derived from individual peaks, regardless of the time of their occurrence. (2) Power rates not yielding an appreciable return on property involved, but yielding operating expenses, and not prejudicial to other consumers, should not be disapproved on the ground that they are discriminatory if no benefit would thereby accrue to other customers because of the fact that these rates are involved in a group of contracts executed at arm's length and assuring to the utility the continuance of a water supply, a coal supply and right-of-way privileges at reasonable costs, especially when an increase in rates would result in cancellation of the contracts and a revision upward of charges for other services.

Recent Court Decisions

Power of Commission to Raise Rates Despite Contract.—The power of the Tennessee Railroad and Public Utilities Commission to permit an electric light and power company to increase its rates notwithstanding contract with a municipality has been again upheld by the Supreme Court of the state in Shelbyville vs. Southern Cities Power Company. The town of Shelbyville held that the act creating the commission is unconstitutional in so far as it authorizes the commission to alter rates fixed by a written contract between the company and a city or town served by it. The previous holding of the Supreme Court was made in Memphis vs. B. A. Enloe.

Supplier of Electricity Who Has Knowledge of Defects in Customer's Wires Is Liable.—The Supreme Court of Alabama has affirmed a verdict for the plaintiff in Jones vs. Alabama Power Company, in which damages were sought for the death of a boy who came into contact with a partly insulated 2,300-volt transmission wire sagging to within about four feet above a vacant lot used by the public. The maintenance of such a wire, the court held, is negligence, and the fact that the wire did not belong to the power company but to a customer to whom the company transmitted energy did not absolve the company from liability if it knew of the condition of the installation. Exception was taken to a number of things that occurred in the trial, but the Supreme Court overruled all objections and held that none of the following facts in the proceedings in the lower court was objectionable: Admission of testimony that a witness notified some one at the defendant power company's storeroom of the dangerous condition of the wire; admitting testimony as to the condition of the entire length of wire, it not being contested that it was in bad condition; admitting testimony that the way the victim was going was the nearest route to his destination; showing by production of deed what was conveyed to defendant in the purchase of certain properties; question to witness whether the lot was a frequented place, this being a question of fact, not opinion; allowing witness familiar with locality of accident to be asked question illustrated by pointing to diagram. The jury was, the court said, further entitled to decide whether the person on company's premises who was notified by telephone of the bad condition of the wire was an employee of the company. (101 So. 898.)*

Stockholders of Mutual Water Company Not Public Utility Consumers.—In dismissing a petition from the Southern California Edison Company to annul an order of the Railroad Commission of California exempting certain stockholders of the Mount Water Company, a mutual concern purchased by the plaintiff, from payment of water rates, the supreme Court of California held that the sale of the mutual water company's stock to another company engaged in service of public character was not a dedication of the waters to public use so as to come within jurisdiction of the Railroad Commission, where the contract reserved to the stockholders of the water company private water rights previously guaranteed to them. (230 Pac. 661.)

Failure to Warn Employee Who Knew of Danger Not Proximate Cause of Injury.—A workman who was injured while trimming trees to prevent the contact of their branches with telephone wires, he being employed by the telephone company, came into contact with wires owned by the City Light & Traction Company of Sedalia, Mo., and was severely injured. He collected damages of $2,000 from the light company out of court and then sued the telephone company, receiving a verdict in the trial court (Knoles vs. Southwestern Bell Telephone Company). This judgment has been reversed by the Kansas City Court of Appeals, which, although holding that the settlement with the light company did not prevent suit against the telephone company, the amount paid Knoles not having been in full of all claims arising out of injury, found, however, that the plaintiff was contributorily negligent in not seeing the high-voltage wire, which was only a foot or two from the wires he saw. The court declared that the telephone company's failure to warn the tree trimmer that the electric light company's wires through the trees carried heavy charges of electricity was not the proximate cause of his injury, in view of evidence that he knew he must avoid contact with all electric wires. (265 S. W. 1005.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Stop Waste, Reduce Costs

Hoover Urges This as Essential to Economic Distribution—Voluntary Co-operation Necessary

VOLUNTARY co-operation in industry and commerce without governmental regulation, expedited by an extension of the friendly assistance of the government agencies in organization and information, is one of the means of solving the problem of our distribution system, according to views expressed by Secretary Hoover in an address before the recent national distribution conference at the United States Chamber of Commerce, Washington. Mr. Hoover says that the outstanding problem of our distribution system can be easily summarized in one question. Can we reduce the margin between our farmer and manufacturing producers on one side and our consumers on the other? Mr. Hoover is convinced that we can and that it can be done without reduction of wages or legitimate profits.

"These possibilities lie in the elimination of waste," said Mr. Hoover. "Such wastes are not the small change of industry and commerce. There is scarcely a step in this accomplishment of squeezing out waste which does not interpret itself in millions of dollars of annual saving. I have hesitated to make so general a pronouncement until I felt that we could not only clearly demonstrate the existence of such great wastes but also demonstrate from actual experience the practicability of their elimination and the method of doing it. The area of profits in the margin has been pretty well eliminated in the past two years. During the period of inflation and deflation there were both undue profits and undue losses, both equally a burden upon the producer and consumer. But with the general stabilization in prices the processes of competition have attended to this job."

Lack of Statistics on Economic Waste

Secretary Hoover made it clear that in speaking of waste he referred to economic waste and did not mean waste in the sense of willful waste. The kinds of waste that cause costly losses were mentioned as speculation, relaxation of effort, extravagance of booms, seasonal production, lack of standards, unnecessary multiplication, lack of uniformity of business practices, deterioration of commodities, inadequate transportation and terminals, disorderly marketing, too many links in the distribution chain, bad credits, destructive competition, enormous expenditure of effort and money in advertising and sales promotion without adequate basic information, unfair practices of a small minority, and a multitude of wastes in use of materials, in unnecessary fire destruction, in traffic accidents and in many other directions.

One of the kinds of waste mentioned by Secretary Hoover was that caused through lack of information as to national stocks, production and consumption, with its attendant risk and speculation. "It is a truism to say that no individual business enterprise can succeed or be conducted without waste," Secretary Hoover remarked, "if it does not know accurately its stocks, the volume of output or sales, the rate of stock turnover, or its orders, or the prices, assets and liabilities and the relation of these to previous periods. Neither can the business of a trade, as a whole, or the nation itself, function efficiently unless it knows these things.

"Statistics are a counterpoise to 'psychology' in business—an anchor of basic facts to tie to. The gigantic waste from the boom of 1920 through the depreciation in value of excessive stocks would have been much minimized if there had been more complete information as to the volume of those stocks. The best protection against booms is that every business man shall have such information that he may realize from the shifts in credit, from the movements in stocks, of production and consumption, that the economic balance wheel is moving too fast, and if every man then safeguards against danger, disaster never comes."

It is only through the co-operation of well-disposed trade and industry, and through a wider understanding of the problems involved and of the co-ordination of effort necessary to obtain results, that progress can be made. "This is not emergency work," Secretary Hoover said, "as new wastes will constantly arise and permanent trade organizations are needed in each industry for their elimination."

[NOTE.—The ELECTRICAL WORLD has made the definite suggestion in more than one instance that its pages be used for the clearance and publication of mass statistics of electrical manufacturers.—EDITOR.

Railroad Electrification Progress

Much Construction Under Way—Improvement in the Outlook for the Railroads a Big Factor in Carrying Out Electrification Programs

PROMINENT as being the railroad most likely to start extensive electrification plans during this year is the Pennsylvania Railroad. Rumors that appear to be well founded are current that this railroad will electrify its line between New York City and Washington. This was reported in the ELECTRICAL WORLD of January 10. Apparently this project will be placed ahead of that for electrifying the mountain grades in the vicinity of Altoona, which was tentatively decided on several years ago.

The complete plan involves a four-track system about 220 miles long and it is estimated that the total cost of electrification will be upward of $50,000,000. It is reported that an overhead system will be used similar to that now installed on the Paoli division out of Philadelphia. When completed, this electrification will give a high-speed electric service from Washington to New York and to New Haven, Conn., in conjunction with the New York, New Haven & Hartford Railroad. It has been asserted that the electrical power required will be purchased from utilities located along the lines, such as the Public Service Electric & Gas Company, the Philadelphia Electric Company and its subsidiary the Susquehanna Power Company, the Potomac Edison Company and the Consolidated Gas, Electric Light & Power Company of Baltimore. All of these central-station companies are actually building or have plans under way for plants or extensions which will be able to take care of the load requirements of the railroad when they shall occur.

Practically every important railroad in the East has made electrification plans at one time or another, but action on them has been withheld, chiefly owing to the difficulties of financing. The improvement in the outlook for the railroads (also reflected in the stock market), the increase in traffic in certain sections of the country, the election and the tremendous restoration of confidence have again forcibly emphasized railroad electrification plans. This has taken very definite form in recent announcements. The most important of these projects definitely proceeding is the electrification of the Illinois Central Railroad of Chicago (see ELECTRICAL WORLD, issue of November 22).

It is stated that the expenditure for suburban electrification of this railroad will be about thirty million dollars. Several contracts have been awarded and work on them is now in progress. The electric zone extends a distance of 28 miles from the terminal and comprises a total of 37 miles of route, including two, four and six-track sections.

Manufacturers' Yearly Reviews Optimistic

The Westinghouse and General Electric companies in their reviews for the year 1924 point to the large number of electrical equipments for main-line motive power units that have been put in service or are in process of manufacture. Sales of heavy traction equip-

ment have shown a steady improvement, and inquiries now on hand indicate a continuance of this trend.

CONSTRUCTION WORK PROGRESSING

Aside from the Illinois Central Railroad above mentioned, several electrification projects are now in process of construction. The Long Island Railroad began work on its Jamaica-Babylon electrification during last year. This comprises 28 miles of line and will cost $4,000,000. It will convert one of the largest remaining sections of the system to electric operation. The Pennsylvania Railroad extended its 11,000-volt, single-phase electrification in the Philadelphia suburban zone by converting the Fort Washington branch to electric service. This is a 6-mile line connecting with the Chestnut Hill branch. The electrification of the Staten Island Rapid Transit lines, including some 40 miles of track, is well under way. Work on the Virginian Railway has progressed to a point where it is expected that the road will be opened for electric service during this year.

The Norfolk & Western Railroad has not announced any definite program, but its electrical zone is gradually being extended. The initial electrification of the Detroit & Ironton Railroad consists of approximately 17 miles of double track, extending from the River Rouge Plant of the Ford Motor Company to Flat Rock, Mich. This railroad, which will operate at 22,000 volts, single-phase, will use a motor-generator type of locomotive that is a radical departure from existing standards. The Danbury-South Norwalk line of the New York, New Haven & Hartford Railroad is now under way and will complete the electrification of virtually all the track of the company between New York and New Haven. All main-line trains, both freight and passenger, have been hauled electrically for nearly a year.

AN ENTIRELY DIFFERENT KIND OF RAILROAD ELECTRIFICATION

An electrification of an entirely different kind inaugurated during the year was that of the Missouri-Kansas-Texas Railroad between Dallas and Denton, Tex. This line has been equipped with an overhead trolley and the necessary 600-volt direct-current power supply. It is planned to operate passenger service in the same manner as on light interurban roads and with light one-man cars. Through passenger and freight service will still be given by steam trains.

In Europe greater progress is being made in electric traction than in this country—owing chiefly to economic reasons, the price of coal being high while water power in some countries is available and is cheap. The Swiss Federal Railways will be completely electrified in the near future. The Paris-Lyons-Mediterranean Railway in France is following through an extensive electrification program that involves most of its lines in southern France. Here, too, much of the power will be supplied by hydro-electric stations. The Southern Railway of England, which includes a number of the suburban lines operating out of London, is proceeding with its electrification, having increased the electrified route-miles from 85 to 145 and the track-miles from 248 to 358. However, there is every indication now that progress in the United States in the next few years will be much greater than in the past.

Heaviest Freight Traffic in 1925 to Move Smoothly

THE heaviest freight traffic in history is expected by the railroads during the first quarter of 1925 as a result of the steady improvement in business. Co-operation in handling this was pledged by railroad and industrial executives at the first annual meeting of the Atlantic States Shippers' Advisory Board, held January 8 at the Hotel Commodore, New York. The organized co-operation of the shippers enabled the railroads to move a tremendous volume of traffic in 1924. The ability of the railroads to do this promptly was aptly demonstrated to the electrical industry when the twenty-two-carload shipment of generating equipment manufactured by the General Electric Company was shipped to the Southern California Edison Company in eight days. Details of this record shipment were reported in the ELECTRICAL WORLD for August 30 and September 6, 1924.

Patrick E. Crowley, president of the New York Central Railroad, said at the meeting that industry bears to transportation the same relationship that a through ticket does to its coupon—"void if detached." He expressed the desire that during the coming year there will be no process of detachment through lack of co-operation in the work of the Atlantic States Shippers' Board and that business will be given an unvoided through ticket. Various railroad executives said at the meeting that there will be an ample amount of equipment in excellent condition to handle all traffic in the first quarter of 1925.

Radio Versus Heat-Pad Thermostats

Letter from a Sanitarium Brings Up a Point of Alleged Conflict Between Radio and the Warming Pad—Maybe the Radio Man Can Help

BY T. C. RUSSELL
Russell Electric Company, Chicago

WE RECENTLY had a letter from a dealer established in a sanitarium town devoted to the treatment of tubercular patients informing us that he sells three dozen heating pads a year and asking whether we would guarantee that our heating pads would not interfere with radio reception. He made this a necessary condition of purchase because the local radio club had made investigations and found that some heating pads did interfere with radio reception.

I answered this letter in a semi-serious manner and suggested that if heating pads interfere with radio reception the same must be equally true of doorbells, telephones, electric lights, street cars, and in fact any kind of electrical apparatus. I suggested that the radio "fans" discontinue the use of all of these various devices in order that there may be no interference with radio.

The dealer referred this matter to the resident physician at the sanitarium, who wrote at greater length, explaining that the difficulty was due to the operation of the thermostat. He said that any pad which interfered with radio reception would have little or no sales value in the town and that this situation would without doubt eventually occur in other health resorts.

I wrote back saying that I was reminded of the story of the president of a manufacturing company who was annoyed every time the safety valve of his boiler blew off and therefore instructed the engineer to tie down the valve. We know what happened to that power plant, and the same thing is going to happen eventually to every electric heating pad that does not have a thermostat in control. Every reputable heating pad has a thermostat as a necessary protection against overheating, and if the stand taken by this sanitarium becomes general it will bar the use of reputable makes of pads. To complain against the heating pad because of this electrical characteristic is equivalent to telling the patient that it is perfectly right as long as the radio comes in clear and strong for him to use a heating pad that will, the first time it is not carefully watched, burn up the bed, the hospital and maybe the patient.

It seems to me that men who install radio reception sets in hospitals should know the facts and when complaint of the operation of the heat-pad thermostat is made the truth should be carefully explained, so that the patient, the doctor and the nurse will all thoroughly understand the reason for it.

Lighting Equipment Sales in 1925 Over $100,000,000

A PROMINENT manufacturer of lighting equipment has estimated that sales will probably exceed one hundred million dollars in 1925. This figure is based on a conservative estimate of 2 per cent of a predicted construction of five billion dollars for 1925. This only takes into account the lighting equipment required for new buildings. But as there has been an increased interest shown in replacing old equipment, total sales are expected to run well over one hundred million dollars in value. It has been estimated that this year will see an increased demand for industrial buildings, public works and utilities and the smaller types of residential buildings, with a consequent increase in the demand for lighting equipment for these types of buildings.

The report of the Employment Serv-

ice Bureau of the Department of Labor shows that the building activity for 1925 will equal and in some sections exceed that in 1924. This is also borne out by reports from various other sources. Taking all districts from coast to coast, there is a striking unanimity of opinion expressed by local directors of the survey that residential and commercial construction will continue on a satisfactory scale which will keep the building trades employed.

Business Conditions

MARKET conditions in the industry are reported by electrical men as good despite the fact that sales since the first of the month have not increased uniformly in all lines. On some commodities, as wire and cable, the demand is stated by several manufacturers to be very good and in one instance is said to be better than in any previous January. The increases in the prices of copper and lead have caused necessary increases in manufactured products employing these metals, but there is no tendency on the part of manufacturers to increase prices indiscriminately even in lines that are enjoying a very good demand.

Central-station companies have made up large budgets, many of which are still awaiting approval. Orders for equipment from these sources are expected to reach a peak in March and April and to be in excellent volume. It is usual for heavy buying by utilities to be "off" at this period. Bookings of the Westinghouse Electric & Manufacturing Company for the quarter ended December 31, 1924, are said to be $38,653,700, which compares with $36,435,500 for the same quarter in 1923 and $34,705,000 for the quarter ended September 30, 1924.

In New England requests for quotations on equipment are in the hands of manufacturers and jobbers, and it is expected that a number of large orders for transformers and high-voltage switching equipment will be closed in the near future. Wire and cable are being purchased in very good volume in the New York district, and general industrial business is slowly improving. In the Southeast orders being received are mainly for poles and pole-line materials for use in Florida and South Carolina. The continuance of inclement weather has stopped the majority of building activities in many sections. Business is active in the Middle West, and the railroads are purchasing heavily. Utilities are buying construction material in good volume. On the Pacific Coast many small orders are being received from mines, lumber companies and irrigation districts. General conditions are good, and the volume of building operations is being well maintained.

Westinghouse District Managers Report Business Progress

THREE district managers of the Westinghouse Electric & Manufacturing Company who met in New York last week to attend the annual merchandising conferences of the company spoke encouragingly of the prospects for better business in their territory. L. M. Cargo, manager for the Rocky Mountain district, said that the largest single factor in the progress of his section was the electrification of industry and that oil fields were active in this respect. The electrification of divisions of every transcontinental road within the next decade was asserted by Mr. Cargo to be an economic necessity.

N. G. Symonds, manager for the North Central West and the Northwest, said that the business from all states in his territory is now good with the exception of Iowa. Poor business in Iowa has been due to the failure of the 1924 corn crop, but as a good wheat yield is expected this year this state should recover financially and agriculturally. Sales of radio apparatus in North Dakota are said to be exceptionally good. C. E. Allen, manager for the Middle West, said that Arkansas would soon rival the Carolinas industrially as the opening up of power zones had attracted textile, milling and other manufacturing plants.

Radio Sales for 1925 Predicted to Be $450,000,000

THE demand for radio apparatus was exceptionally good in the last two months of 1924. The sales of the Radio Corporation of America for that period are estimated at $22,000,000—a record figure. David Sarnoff, vice-president and general manager of the Radio corporation, has estimated the total radio sales by all companies for 1924 as $350,000,000. This checks with the amount estimated about a year ago and compares with total sales of $120,000,000 for 1923, $60,000,000 for 1922 and $5,000,000 for 1921. Based on the rate of increased demand during the preceding five years, Mr. Sarnoff has predicted total sales for 1925 as $450,000,000. An active demand for radio apparatus is also reflected in the increase of capital stock of several companies and the placing of new issues on the market.

Strong Downward Reaction in Non-Ferrous Metal Prices

MARKED slackening in the domestic demand since the holidays has weakened the non-ferrous metal market, and there has been a pronounced decline in prices. Consumers generally are making no commitments until they see how far the reaction will go. During the last two or three months there has been heavy buying and a continued advance in prices so that this reaction was more or less anticipated. As fundamental business conditions, however, are good, there is nothing to indicate why this reaction should be continued for any great length of time. Sales of copper have been mostly of speculative and odd lots. Consumers have not shown much interest, especially since the reaction in prices was evident. The brass companies in particular, however, are buying up any lots offered at 14⅞ cents to 15 cents delivered. The large producers are showing no tendency to follow the market below 15 cents, and some are yet quoting 15¼ cents. The export market has been very inactive.

The American Smelting & Refining Company reduced its official contract price for lead from 10¼ cents to 10 cents on Wednesday. This reduction is owing to the decline in lead prices in London. Consumption remains good, and buyers have small stocks, but the tendency has been to remain out of the market rather than pay more than 10 cents. Zinc has followed the downward trend of the market. Most of the sales have been made for January shipment, though some metal has been booked for as late as April. Sales of tin were in fair volume the latter part of last week, when slight declines in prices were taken advantage of, but the pronounced drop yesterday, when prices declined one cent during the day, has caused buyers to hesitate.

NEW YORK METAL MARKET PRICES

	Jan. 14, 1925 Cents per Pound	Jan. 21, 1925 Cents per Pound
Copper, electrolytic	15⅛	14⅛
Lead, Am. S. & R. price	10¼	10
Antimony	17⅛	17⅛
Nickel, ingot	31	31
Zinc, spot	8.22½	7.95-8
Tin, Straits	58⅛	56
Aluminum, 98 to 99 per cent	28	28

Transmission Equipment Active in New England Market

IMPORTANT transmission work coming to a head in New England this spring is reflected in an increased number of requests for quotations from manufacturers and jobbers, and it is expected that a number of large orders for transformers and high-voltage switching equipment will be closed in the near future. Specifications are being prepared for two 37,500-kva. transformers for the Weymouth-West Medway 110,000-volt line of the Boston Edison company and for one 5,000-kva. and two 15,000-kva. units for the Walpole and West Medway substations. The Farmington River hydro-electric development in Connecticut will also be a transmission equipment factor in the regional market before long, and waterwheel-driven generators are being figured in current bidding for developments in central New England.

Sales reports from the jobbers show a healthy and growing movement of line material, and some carload business in pipe has been booked from large Boston contractors. The upward trend in copper has stimulated wire sales. Three carloads of weatherproof wire were sold within a few days for central-station use in eastern Massachusetts. Inquiries from industries are now about equal in volume to those from utilities. The textile field is reviving, and a large order involving some fifty motors is on the point of closing. Railroad budgets are in the

making. Improved finances on the New Haven system will no doubt be reflected in electrical purchases this spring. Washers, cleaners, portable lamps, refrigerating outfits and radio apparatus are selling well. A Boston department store sold about 800 high-grade radio sets in four days last week.

Orders in Southeast Mainly for Poles and Pole-Line Materials

SUCH orders as are being received in the Southeast are mostly for poles and pole-line materials going to Florida and portions of South Carolina where holding companies have recently acquired utility properties and are now busily engaged in rehabilitating the systems. Telephone-line extensions in Florida are requiring a satisfactory volume of telephone equipment, and orders from this state for ornamental street-lighting equipment are also reported good. Sales of electric ranges dropped off considerably during December. This commodity is reported as slow, despite efforts of central-station companies to accelerate the demand.

The continuation of very inclement weather throughout the section has served to stop in large degree the majority of building activities, and this, combined with the unusually long post-holiday lull, has been the cause of decreased sales. Jobbers are taking advantage of the lull to call in their field men for sales conferences and educational and inspirational work in anticipation of activities above the average when conditions right themselves. Advertising and intensive sales efforts during the past few months have served to hold up the volume of lamp and commercial lighting-fixture sales, and prospects are good. Jobbers' sales to contractors, with but few exceptions, are off badly, but a considerable number of industrial jobs are expected to be placed immediately after directors' meetings which are scheduled to take place this month.

Many Small Orders Received on Pacific Coast—Conditions Good

GENERAL conditions on the Pacific Coast are good and the volume of building operations is being maintained. Mines, lumber companies and irrigation districts continue to provide a number of five-hundred-dollar and thousand-dollar orders. A recent inquiry by a central-station company for 10,000 braces produced exceedingly keen competition among manufacturers. Most contractors' orders cover many carton items, the carton basis being apparently considered safer than the package. Orders and inquiries include 1,850 60-watt carbon lamps, largely natural red and green; $5,000 worth of tree wire and fifty-piece orders for post-hole spoons and other construction tools, there being 4 ft. of packed snow on the mountains. A railroad inquiry for 60,000 ft. of ¼-in. and ⅜-in. Siemens-Martin strand and 900 poles of 20-ft. and 25-ft. sizes were also received.

A molders' strike in San Francisco as a result of the adoption of the American plan by foundries has not spread to other industries and has apparently occasioned little delay by other crafts. Up to January 1 the radiator season, from present indications, ran very close to last season's volume. In January, 1924, however, an unusual cold spell caused heavy reordering, which so far this January has not occurred. Los Angeles is making the best proportionate showing in the sales of radiators. Fan prices and contracts were in the hands of the jobbers' salesmen about January 15. No consignment or stock returns are being allowed.

Good Sales of Wire and Cable in New York District

SALES of wire and cable are in very good volume in the New York district, with all lines moving equally well. Several manufacturers reported increased business, and one company stated that its business received from all sources so far in January is better than in any previous year. The rise in price of copper and lead has forced increased prices on cable from some quarters this week. It is believed that similar increases will also be announced by other companies. The demand for the best grade of portable heavy-duty cord is very good, and sales in one case are said to be increasing rapidly, with the trend toward equipping various appliances.

Industrial firms are slowly becoming more active, and, although individually small, more orders are being placed than in some time. Utility companies are not placing orders for large equipment, mainly owing to the fact that budgets still await approval. However, it is known that these budgets are large and cover many projects which are confidently expected to be launched this year, financial conditions being decidedly favorable. It is believed that March and April—which are usually heavy buying months—will be productive of many orders.

Business Active in Middle West—Railroads Purchasing Heavily

BUSINESS in most parts of the Middle West remains active. Industrial purchasing is steadily increasing, and evidence of continued good business is more and more apparent. Several of the railroads in this territory are now purchasing equipment rather heavily. The Illinois Central Railroad is reported as prepared to start work soon on a six-million-dollar shop at Paducah, Ky. Purchasing by the various utility companies remains generally good, with particular demand for pole-line hardware, insulators, weatherproof cable, etc.

Considerable business was transacted in weatherproof wire and conduit, and portable-drill sales were quite noticeable. Prices remain generally firm, although loom advanced a few points, copper products advanced ¼ cent per lb. and code wire advanced approximately 2½ per cent. While conduit prices have not changed, it is generally believed that there will be a large demand for this product during the coming year, and inasmuch as only a few additions to present manufacturing plants have been made, some price readjustments are anticipated by consumers and jobbers, although there is nothing to indicate definitely when this adjustment will take place.

Activities of the Trade

Maytag Holds Sales Conference at Newton Plant

At the Maytag Company's plant at Newton, Iowa, more than three hundred salesmen gathered during the second week of January. The occasion was the twentieth annual conference of the company's washing-machine salesmen. F. L. Maytag, chairman of the board of directors, opened the three-day sessions on January 8 with an address on the developments during 1924. These resulted in the sale of washing machines having a retail value of $18,000,000. Various topics covering sales approaches, advertising and concentrated selling methods were discussed. The conference closed with a banquet at the Hotel Savery, Des Moines, January 10, at which L. B. Maytag, president, presided.

Westinghouse Orders for Third Quarter Show Gain

Orders booked by the Westinghouse Electric & Manufacturing Company in the quarter ended December 31 show a total of $38,653,700, compared with $36,435,500 in the same quarter of 1923, and $34,705,000 in the quarter ended September 30, 1924. The billings of the company for the December 31 quarter were $41,088,000, compared with $39,195,000 in the same period of 1923 and $39,573,000 in the September quarter of 1924.

Orders for the nine months ended December 31 totaled $113,387,000, against $126,024,600 in the same period of the preceding fiscal year, which ends March 31, 1925. Billings in the nine months were $118,921,000, against $112,910,300 for the same period in the preceding year.

Wagner Electric Organizes Fan Sales Department

The Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, announces that it has organized its fan sales department. The Wagner company, as has already been announced, has recently embarked upon the manufacture of a new line of fans for domestic and general service.

The manager of the fan sales department will be L. L. Goding. Mr. Goding is a native of Portland, Me., and has had considerable electrical merchandising experience, having been connected with the Century Electric Company, the Jenney Electric Motor Division of the Arvac Manufacturing Company, Fairbanks, Morse & Company and the Peerless Electric Com-

pany. At the same time I. Elkas has been appointed special representative of the fan sales department. Mr. Elkas takes with him many years of sales experience. For twelve years he was district sales manager for the Robbins & Myers Company. Previous to that time he was manager of the Sprague Electric Works, Division of the General Electric Company, St. Louis.

Jointless Fire Brick Company Occupies New Factory at Trenton

Shipments of "Plibrico" furnace lining are now being made from the new factory just recently completed at Trenton, N. J., for the Jointless Fire Brick Company of Chicago. The company announces that this new factory was built to serve the "Plibrico" distributing centers in the East that can be reached by water. One of the interesting features of this new, modern refractory plant is the laboratory, which is said to be well equipped and manned to solve refractory problems.

Liberty Gauge & Instrument Moves to Larger Quarters

The Liberty Gauge & Instrument Company, Cleveland, manufacturer of electric hot plates and table stoves, announces that its new address will shortly be 6612 Euclid Avenue. The company states that this change has been made necessary in order to serve its customers better and also that its plans for increased production may be quickly materialized. The new quarters will provide sufficient space to double its present capacity.

Reliance Electric & Engineering Enlarges Plant Facilities

Enlargement of the plant facilities of the Reliance Electric & Engineering Company, Cleveland, has become necessary to take care of the increased production of its new line of polyphase induction motors and an increased range of sizes on direct-current motors, which are now made up to 250 hp., according to C. L. Collens, president of the company. Mr. Collens is also chairman of the Electrical Manufacturers' Council. A contract for a new building has been awarded by the Reliance company to the Austin company, Cleveland, engineer and builder (announced in the ELECTRICAL WORLD for January 17). The Reliance company states that although 1924 was a year below normal in the motor-manufacturing industry, the business handled by this company was virtually the same as that of 1923. The company is definitely planning on a one-third increase in output for 1925.

The new extension includes a one-story section, with sawtooth roof, and a two-story section—both of mill-type construction. The one-story section is to be used to increase the machine shop and assembly departments as well as for finished stock storage. The two-story section will be devoted to the armature and coil-winding department. The Austin company is preparing complete plans now and expects to finish all construction work by about March 15.

Fixture Manufacturers to Combine Market with Convention

The National Council of Lighting Fixture Manufacturers definitely decided at its board meeting held in Philadelphia on January 13 that it would not hold a national show or a regional show this year. However, the board feels that because of the requests it has received from the majority of its members it will be necessary to hold a market in conjunction with its annual convention, to be held about the middle of March. The definite date and location will be announced by the council at a later date.

Electric Service Supplies Makes Large Shipment to Middle West

The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, has just made two large rush shipments of insulators and high-tension equipment into Indiana and Iowa territory. One of these shipments amounted to two carloads and was forwarded by express. The larger volume of business being obtained by this company is for material used in the construction of high-tension lines and in the carrying out of consolidation construction programs. Sales of material to take care of distribution expansion in the metropolitan areas are said to be in comparatively smaller amounts.

Westinghouse Gets Orders from Cement Company and Railroad

The Westinghouse Electric & Manufacturing Company has recently received a contract from the Crescent Portland Cement Company for power-plant equipment to be used to modernize the present plant at Crescentvale, Pa. The equipment consists of two 3,000-kw., 2,200-volt, three-phase, 60-cycle turbo-generator units equipped with surface condensers and auxiliaries. In addition, the contract calls for a switchboard substation and six 500-kva. transformers.

An order has also been received from the New York, New Haven & Hartford Railroad for a 9,000-kw. turbine and condenser for use at the Cos Cob (Conn.) generating station, replacing one of the 3,750-kva. turbo-generators, which will be used in some other part of the power system. This will complete the electrification of the Cos Cob station.

Landis & Gyr of Switzerland Appoint United States Agent

Landis & Gyr, Ltd., Zoug, Switzerland, manufacturers of a complete line of meters, have appointed as their sole agents in the United States L. H. Junod & Company, 104 Fifth Avenue, New York. Louis H. Junod of the firm of L. H. Junod & Company has been for many years the Consul of Switzerland at New York. The current items of the company's line, as well as all spare parts, will be carried in stock in New York.

The line includes, besides standard watt-hour meters for alternating-current and direct-current circuits, many specialties, among which is the "maxigraph," the company's chart-recording instrument. This instrument is said to contain many interesting features as regards its construction and performance and is different from the types in general use in this country.

Bell Telephone Laboratories New Research Organization

The growth of the research and development work of the Bell System has led to the formation of Bell Telephone Laboratories, Incorporated, organized on January 1, 1925, for the purpose of carrying on development and research activities in the communication and allied fields This new company, jointly owned by the American Telephone & Telegraph Company and the Western Electric Company, has taken over the personnel, buildings and equipment of the research laboratories of these two companies, which were formerly operated as the engineering department of the Western Electric Company.

Extensions of laboratory facilities are already under way, consisting of a new building covering almost a quarter of a city block. The chairman of the board of directors of the new company is General J. J. Carty, vice-president of the American Telephone & Telegraph Company. Other members of the board are Dr. F. B. Jewett, formerly vice-president of the Western Electric Company, who is president of the new corporation and also recently elected vice-president of the American Telephone & Telegraph Company; W. S. Gifford, just elected president of the American Telephone & Telegraph Company; Bancroft Gherardi, vice-president of the same company; C. G. DuBois, president, and J. L. Kilpatrick, vice-president of the Western Electric Company, and J. B. Odell, assistant to the president of the Western Electric Company.

The Joslyn Manufacturing & Supply Company, 133 West Washington Street, Chicago, manufacturer of pole-line construction material, has awarded a general contract for the construction of a new one-story plant, 130 ft. x 210 ft., at 3700 South Morgan Street, estimated to cost $100,000. A large part of the structure will be equipped for galvanizing service.

The Circle F Manufacturing Company, Trenton, N. J., is the name of the new company formed by the consolidation of the Trenton Porcelain Company and the E. H. Freeman Electric Company. This corrects the footnote appearing on page 174 of last week's issue in connection with an article concerning a new price sheet of the E. H. Freeman Electric Company.

The Mueller Electric Company, 1583 East Thirty-first Street, Cleveland, manufacturer of electrical specialties, has awarded a contract for the erection of a one-story brick and steel addition, 38 ft. x 60 ft. in size.

The Line Material Company, South Milwaukee, Wis., manufacturer of transmission and distribution equipment, has added to its line of racks a new underground rack for supporting cables in tunnels, manholes, etc. It is made of galvanized steel with the ends twisted at right angles and drilled for

½-in. bolts. It is furnished in one-step to five-step sizes and has a stock spacing of 7 in., although other spacing can be furnished if desired. Racks, steps and insulators are detachable and can be obtained separately, if required.

The Coleman Engineering Company, sales agent and engineer, announces that it has moved from Sioux Falls, S. D., and is now located at 3 West Third Street, Sioux City, Iowa.

The Johns Pratt Company, Hartford, Conn., announces the appointment of B. Franklin Conner as sales manager of the molding division, effective January 31. Mr. Conner was formerly general sales manager for the Auburn Button Works, Auburn, N. Y.

The Morgan Engineering Company, Alliance, Ohio, manufacturer of electric traveling cranes, etc., announces the appointment of the following district representatives: C. O. Cromwell, 2230 First National Bank Building, Detroit; F. E. Bausch, 1105 Chemical Building, St. Louis; Duncan A. MacLeod, 918 Ellicott Square, Buffalo; R. R. Glover, 2310 Union Central Building, Cincinnati; W. R. McDonough & Company, First National Bank Building, Cleveland; McMullen Machinery Company, 64 Ionia Avenue, Grand Rapids, Mich.; Millholland Sales & Engineering Company, 225 Indiana Terminal Warehouse Building, Indianapolis; C. B. Davis Engineering Company, Brown-Marx Building, Birmingham; P. I. Perkins Company, 110 High Street, Boston; Stewart H. Ford, Mutual Building, Richmond, Va.

The Electric Vacuum Cleaner Company, Inc., Cleveland, manufacturer of the "Premier Duplex," announces the appointment of Ralph B. Wilson as manager of central-station sales. Mr. Wilson has been with his present company for the last three and one-half years as director of branches and succeeds Hearne O. Adams, who recently resigned. This position entailed the management of the Premier Service Company, which is a subsidiary of the Electric Vacuum Cleaner Company, operating in all the principal cities of the United States and Canada as a distributing, retail and service outlet for the "Premier Duplex." Mr. Wilson plans to leave Cleveland shortly to visit many of the central stations throughout the United States.

The Roller-Smith Company, 233 Broadway, New York, manufacturer of electrical instruments and circuit breakers, announces the appointment of W. H. Pugh as its representative in the northeastern part of Pennsylvania, with headquarters at its factory at Bethlehem, Pa. Until recently Mr. Pugh represented the Roller-Smith Company in the territory immediately adjoining Bethlehem, but on the first of the year his territory was enlarged as mentioned above. Previous to taking up sales work Mr. Pugh was superintendent of the company's works.

The American Blower Company, Detroit, is now producing a "Venturafin unit heater" having about three times the heating capacity of the original unit, which was placed on the market last year. The original small unit weighs 320 lb. and has a capacity ranging from 125,000 B.t.u. to 162,500 B.t.u. per hour, depending on initial and final temperatures. The larger unit delivers from 500,000 B.t.u. to 650,000 B.t.u. per hour and weighs 1,060 lb.

The H. B. Sherman Manufacturing Company, Battle Creek, Mich., manufacturer of brass goods, announces the production of a new battery clip in one piece made of special spring steel coated with hot lead. The clip is made in two sizes, the No. 50 with a capacity of 50 amp. and the No. 25 with a capacity of 25 amp.

The Republic Varnish Company, 201 Thomas Street, Newark, N. J., announces that F. C. Eibell, formerly with the advertising department of the Yale & Towne Manufacturing Company, Stamford, Conn., has been appointed advertising manager.

New Equipment Available

Electric CO_2 Meter

A new electric CO_2 meter that utilizes the method of gas analysis based on the fact that CO_2 conducts heat at a different rate than air has been placed on the market by the Brown Instrument Company, Philadelphia. As the ability of the gas to conduct heat varies with the CO_2 content, the same amount of current is sent through two wires, one being surrounded by air and the other by flue gas. As the resistance of the wire varies with its temperature, the amount of current flowing varies with the CO_2 content. With the use of a Wheatstone bridge the CO_2 indicator or recorder, merely a milli-voltmeter graduated in per cent CO_2, shows the unbalancing of the bridge. The meter equipment consist of seven units which are said to be rugged and easily installed.

Controller for Oil-Well Motor

A controller for use with the two-speed, pole-changing type of wound-rotor induction motors used for pumping and cleaning oil wells has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. The controller is assembled as a complete unit so that it can be easily transported and set up. Two drum-type controllers are supplied, the smaller being used to change over from one of the two running speeds to the other and the larger for starting up the motor and regulating the speed. In addition to operating handles both drums have sheave wheels so that they can be operated mechanically from a remote point. An inclosed triple-pole fused main-line switch and a protective panel are mounted on the framework. The resistance grids are mounted inside the framework.

Starters for Fynn-Weichsel Motors

A line of starters for use with the Fynn-Weichsel alternating-current motor has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. These starters take care of cutting out resistance simultaneously in each of the two secondary windings found in this type of motor. The starter is of the fully inclosed type. A small handle extending outside the inclosure provides a means for stopping the motor. No-voltage and overload release can be obtained by using in conjunction with the starter a magnetic contactor and overload movement. An electrical interlock is provided so that in the event of voltage failure the contactor opens and the manually operated starter must be returned to the starting position before the contactor can again be closed. This starter is made for motors up to and including 50 hp., all voltages.

For motors of larger capacity than can suitably be controlled on the face-plate-type starter used with the smaller motor a drum construction has been developed. A primary contactor and overload relay panel is used in conjunction with the drum-type starter to provide additional safety features.

Watt-Hour Meter

A three-element watt-hour meter for alternating-current, three-phase, four-wire circuits with unbalanced load has been placed on the market by Landis & Gyr, Ltd., Zoug, Switzerland, through their sole representatives for the United States, L. H. Junod & Company, 104 Fifth Avenue, New York. These meters are independent of the phase sequence, they are bottom-connected and are furnished for any frequency in practice.

Traveling-Grate Stoker

A self-contained traveling-grate stoker intended for installation in boilers ranging up to 600 hp., and to solve the problem of more power in low-capacity, natural-draft installations, has been placed on the market by the Combustion Engineering Corporation, Combustion Engineering Building, Broad Street, New York. This stoker is adaptable to a very wide range of fuels, including non-coking bituminous coals, all kinds of anthracite coals, coke breeze and lignites.

In the design of this self-contained stoker the forced-draft fans are mounted on the stoker frame. Forced-draft ducts are part also of the stoker structure. Air is admitted to the under side of the grate surface by a special damper mechanism which graduates the supply from the front to the rear of the grate. These dampers are operated from the front of the stoker. One motor drives both fans and stoker, each being provided with thorough regulation. The grate is composed of a series of box-shaped, sectional fire bars. These bars are mounted upon chains which engage the sprocket wheels. The stokers are said to have been installed very successfully throughout the British Isles and continental Europe by the associates of the Combustion Engineering Corporation and are now being placed on the American market for the first time.

New Trade Literature

ELECTRICAL PROTECTIVE MATERIALS.—The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, has issued catalog No. 30, containing ninety-six pages, covering its electrical protecting materials and conduit fittings. It gives sizes, prices and information of every kind on its products.

ASH-HANDLING EQUIPMENT. — The Conveyors Corporation of America, 326 West Madison Street, Chicago, has issued a bulletin entitled "American High-Duty Conveyors of 9-Inch Pipe Diameter," designed for handling ashes from power plants having exceptionally high tonnages or operating under unusually severe conditions.

ELECTRIC WARE AND AUTOMATIC RANGES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, is distributing a pamphlet containing a price list of the Westinghouse electric ware and automatic ranges, also ranges and water heaters.

FLEXIBLE COUPLINGS.—The Bartlett Hayward Company, Scott and McHenry Streets, Baltimore, Md., has issued a new catalog covering its "Fast" flexible coupling. Illustrations are given showing the features of the "Fast" double-engagement, all-metal, lubricated flexible coupling.

BOILERS.—Bulletin No. 52 issued by the Heine Boiler Company, St. Louis, describes and illustrates the "Heine" longitudinal-drum boilers. Details of construction are included in the bulletin and other chapters are devoted to circulation and furnace arrangement. Several illustrations are given showing various installations of the boiler.

FANS.—"Trade Winds" is the title of a forty-page bulletin issued by the Dayton Fan & Motor Company Dayton, Ohio, in which it describes and illustrates the various types of the "Dayton" fans and motors. It contains suggestions for specialized campaigns, local advertising and window displays.

OIL ENGINES. — Bulletin No. S-171 issued by the Worthington Pump & Machinery Corporation, 115 Broadway, New York, describes the Worthington double-acting, two-cycle oil engine (Diesel type), which was designed specially for use in the marine field. It contains an illustration showing an engine of 3,000 hp. capacity ready for installation in a ship. The company is also distributing a booklet, entitled "Keeping American Ships on the Seas," which gives a short outline of ship propulsion from the time of galley slaves to the present time.

BLEEDER VALVES. — Catalog F, entitled "Bleeder Valves for Turbines and Bleeder Heaters," issued by the Atwood & Morrill Company, Salem, Mass., describes and illustrates its "20th Century" reverse-current valves, which are particularly adapted for bleeding steam at very low pressure for heating feed water by means of stage heaters in public utility plants. Various other "20th Century" specialties, comprising discharge traps, float chambers, condensate level controller safety valves, bypass valves, balance lever valves and hydraulic lever valves, are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Brazil (No. 13,173) of telephone equipment.

Purchase is desired in India (No. 13,209) of electrical goods, such as switches, cutouts, ceiling roses, insulators, motors, bulbs, wires and cables; (No. 13,217) electrical accessories, and (No. 13,171) generators for train lighting and all electrical supplies.

Purchase is desired in Italy (No. 13,178) of electric starter equipment for automobiles.

Purchase is desired in Java (No. 13,168) of power-station equipment.

Purchase is desired in Norway (No. 13,167) of radio sets and parts.

Purchase is desired in South Africa (No. 13,213) of battery assembly tools.

Purchase is desired in Uruguay (No. 13,166) of electric motors.

An agency is desired in Argentina (No. 13,174) for engines and machinery in general and for electrical goods, wire cable.

An agency is desired in Denmark (No. 210) for fireless cookers.

An agency is desired in Greece (No. 13,169) for city electrical installations, radio sets and parts, telephone and telegraph equipment.

An agency is desired in Sweden (No. 13,170) for electro-medical appliances.

CABLES, WIRE, METERS, ETC., FOR MONTEVIDEO, URUGUAY.—Tenders will be received by the State Electric Light Works, Montevideo, Uruguay, as follows: Until Feb. 18 for furnishing 79,000 meters of lead-covered wires and cables of various sizes; Feb. 19 for 134,000 meters of rubber-insulated wires and cables from 0.75 sq. mm. to 100 sq.mm. for indoor installations; Feb. 27 (1) 3,000 direct-current meters and spares; (2) 17,285 high-tension and low-tension alternating-current meters and spares for private lighting and power installations.

FEEDER PROTECTIVE APPARATUS FOR SYDNEY, AUSTRALIA. — Tenders will be received by the City Council, Sydney, Australia, until March 2 for furnishing 10,000-volt feeder protective apparatus.

MOTOR-DRIVEN ASH EXHAUSTER FOR NEW SOUTH WALES, AUSTRALIA. —Tenders will be received by the New South Wales Government Railways and Tramways, Sydney, Australia, until March 11 for a motor-driven ash exhauster.

ROTARY CONVERTER FOR MELBOURNE, AUSTRALIA.—Tenders will be received by the Electricity Department, Melbourne, Australia, until March 23 for one 2,000-kw. rotary converter with transformer and accessories.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

AUGUSTA, ME. — The Central Maine Power Company has purchased a site on the Androscoggin River, near Clark's Rips, on which it proposes to build a hydro-electric plant in the future. The company has secured permission to issue 10,505 shares in capital stock, part of the proceeds to be used for extensions and improvements.

SPRINGFIELD, MASS. — Extensions contemplated by the United Electric Light Company during the coming year include the construction of a new substation in Wilbraham Avenue and doubling the capacity of fifteen house-lighting circuits.

WINCHESTER, MASS. — Sketches are being made by Kendall, Taylor & Company, 142 Berkley Street, Boston, for an addition to hospital and service, and also revised sketches for power house and laundry, to cost about $150,000, for the directors of the Winchester Hospital.

NEW BRITAIN, CONN. — Work will start at once by the Farmington River Power Company on a new hydro-electric development at Rainbow, to cost about $1,000,000. The work includes the construction of a dam, power house, to be equipped with two 5,000-kva. generating units to operate under 60-ft. head, and a 66,000-volt, 20-mile transmission line to New Britain. The engineering contract has been awarded to the Power Construction & Engineering Corporation, Worcester, Mass. Most of the output will be used by the Stanley Works.

Middle Atlantic States

COLD SPRING, N. Y.—The Cold Spring Light, Heat & Power Company has applied to the Public Service Commission for permission to exercise a franchise granted by the town officials to supply electricity in Philipstown.

ELLICOTTVILLE, N. Y.—The Ellicottville Basket & Lumber Company plans to build a power house and to install electrically operated machinery in its proposed new wood-products mill.

JAMESTOWN, N. Y. — Permission has been granted to the Western New York Electric Company to extend its electric system in a portion of Mayfield for transmission purposes only.

ALLENTOWN, PA.—The Emanuel Slag Company, Inc., plans to build a power house in connection with a new slag plant of 1,200 tons daily capacity, to be erected between Allentown and Catasaqua.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 27, for 3,000 inclosed cartridge fuses, for the local navy yard (Schedule 3199).

POTTSVILLE, PA.—The Pennsylvania Power & Light Company, Allentown, has acquired the plant of the East Penn Electric Company and will merge it with its properties. Plans are being considered for extensions in transmission system in this section.

RIDGWAY, PA.—Plans are under way by the Keystone Power Corporation for extensions and improvements to its system in Ridgway and Kane and in the intervening towns. The Keystone company, it is understood, plans to make connection with the Penn Public Service system at the Warren County line for emergency service.

TAMAQUA, PA.—The Lehigh Coal & Navigation Company, 437 Chestnut Street, Philadelphia, is planning to install electrically operated ventilating equipment and mechanical-draft apparatus at its local Panther Creek collieries, to cost about $100,000.

BALTIMORE, MD.—The United Railways & Electric Company contemplates extensions and improvements during 1925, to cost about $1,535,000.

EAST BANK, W. VA,—The Town Council is considering improvements to the water system and installing an electric street-lighting system.

HARPERS FERRY, W. VA.—The Harpers Ferry Paper Company plans to rebuild its power plant, recently damaged by fire. It also plans to install electric power equipment in connection with the rebuilding of its mill. The total loss is estimated at $250,000. The power plant is operated by the Harpers Ferry Electric Light & Power Company.

MASON CITY, W. VA.—The Wheeling (W. Va.) Steel Corporation, contemplates installing electric power and mining machinery in its local coal properties, recently acquired. The cost is estimated at $800,000.

MONTGOMERY, W. VA. — The Montgomery Utilities Company contemplates extensions and improvements to its distributing system, including the installation of new equipment.

ROANOKE, VA.—The Appalachian Power Company has completed plans for the construction of a 132,000-volt transmission line from Glenlyn to Roanoke. Other transmission lines will be erected covering the Martinsville and Danville districts.

WASHINGTON, D. C.—Bids will be recieved by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 3, for 399 rigging insulators for the Hampton Roads and Mare Island navy yards (Schedule 3162).

WASHINGTON, D. C.—Bids will be received by the Board of District Commissioners, District Building, until Feb. 2, for 1,000 electric fixtures of various design, 400 "Celuria" glass reflectors, 600 "Ivanhoe Trojan" inclosing units, 40 ball shades, 100 receptacles and 100 ceiling fixtures for public schools.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Feb. 7, for electric hoists and motor-driven trolleys, etc. (Panama Circular 1651).

North Central States

JACKSON, MICH. — The Consumers Power Company has applied to the Public Utilities Commission for permission to issue $7,000,000 in capital stock and $1,000,000 in bonds, the proceeds to be used for extensions and improvements in the territory served by the company.

MENOMINEE, MICH.—The installation of a new ornamental lighting system is under consideration by the City Council. The street-lighting service is supplied by the Menominee & Marinette Light & Traction Company.

SAGINAW, MICH.—The installation of 200 additional street lamps this year is under consideration by Commissioner Crabbe.

CLEVELAND, OHIO.—Plans have been prepared by E. J. Cook, engineer, Illumi-

nating Building, for a substation for the Cleveland Electric Illuminating Company, to be erected on Bolivar Road.

NEW PHILADELPHIA, OHIO. — The City Council has authorized George Arnold, city engineer, to prepare plans and estimates for an ornamental lighting system in the Public Square and for radial streets one square each way.

INDIANAPOLIS, IND.—The Interstate Public Service Company contemplates extensions and improvements during 1925, to cost about $3,000,000. The work will include the installation of a 10,000-kw. steam turbo-generator, etc., at the power plant of the Indiana Power Company, Edwardsport; also, initial work on two proposed hydro-electric plants on the Tippecanoe River, near Goshen, transmission line from Edwardsport to Bedford and other steel-tower transmission lines, etc.

CHICAGO, ILL.—The Public Service Company of Northern Illinois has applied to the Commerce Commission for authority to extend its electrical distribution system on the Chicago and Joliet Road and the Willow Springs Road.

DURAND, ILL.—The Citizens' Utilities Company has petitioned the Illinois Commerce Commission for permission to erect a transmission line between South Beloit and Durand, through Harrison and Shirland.

JERSEYVILLE, ILL.—Application has been made by the Central Illinois Public Service Company, Springfield, to erect a transmission line from its local substation to a point near Grafton.

ROCKFORD, ILL.—Extensions and improvements to its service lines, involving an expenditure of $175,000, are contemplated by the Rockford Electric Company during 1925. The work will include an extension of its lines to New Milford, a suburb.

ROCK ISLAND, ILL.—Bids will be received by the city of Rock Island until Jan. 26 for the installation of an ornamental lighting system. The cost is estimated at about $36,000.

ROSCOE, ILL. — The Roscoe Electric Company has applied to the Illinois Commerce Commission for authority to erect and operate a transmission line from Davis Junction to Holcomb.

EAU CLAIRE, WIS. — The Northern States Power Company, Chicago, plans to extend its transmission lines in southwest Pierce County to furnish electricity in the towns of Diamond Bluff, Hager and Bay City.

EAU CLAIRE, WIS.—Plans have been completed by the Northern States Power Company, 208 South La Salle Street, Chicago, for the construction of a dam and power plant on the Chippewa River, near Hayward. A transmission line, 35 miles long, will be erected from the site to supply electrical service in the towns of Hayward, Bass Lake and Stone Lake and to summer residents in Grindstone and Court Oreilles Lake, and also to residents along the line.

GREEN BAY, WIS.—A petition has been presented to the City Council asking for the installation of an ornamental lighting system.

MADISON, WIS.—The Madison Gas & Electric Company is planning extensions and improvements during 1925 to include the installation of a 10,000-kw. steam turbo-generator, boilers, condensing equipment, etc., at its electric generating plant, to cost about $700,000; also, extension to its distributing system, substations, etc., to cost about $85,000.

RIPON, WIS.—Surveys have been completed by the Wisconsin Power, Light & Heat Company, Madison, with a view of extending its transmission lines to supply electricity to consumers along the south shore of Lake Winnebago in Green Lake County, opening up a territory as yet not served with electricity.

LAMBERTON, MINN. — Arrangements have been completed by the W. B. Forshay Company, Minneapolis, to take over the system of the People's Light & Power Company, Lamberton, which serves nineteen communities in the vicinity of Wilmot, Lamberton and Westbrook. The People's company is also taking over the plants and transmission systems of the Fulda (Minn.) Light & Power Company and the Mountain Lake (Minn.) Milling Company. Plans are under way by the Forshay company for the erection of a high-tension line to connect the transmission systems of the Minnesota Electric Distributing Company, Minneapolis, and the People's Light & Power Company.

MILACA, MINN.—The Eastern Minnesota Power Company, Pine City, is considering the construction of a local steam-operated electric power plant to cost about $100 000.

WINONA, MINN.—Bids will be received by the Board of Education until Jan. 28 for the construction of a power house in connection with a proposed junior high school. Croft & Boerner, 1004 Marquette Avenue, Minneapolis, are architects.

CENTERVILLE, IOWA. — The Iowa Southern Utilities Company has arranged for an issue of $1,000,000 in capital stock, part of the proceeds to be used for extensions and improvements, including additional transmission lines.

STORM LAKE, IOWA.—Russell & Fry, we are informed, do not contemplate the construction of an electric plant in Storm Lake, as reported in the issue of Jan. 10.

STRATFORD, IOWA. — Bonds to the amount of $15,000 have been authorized for the construction of a high-tension transmission line to Webster City.

BOONEVILLE, MO. — The Missouri Power & Light Company, Mexico, is planning to build a new local power plant during 1925, to cost about $200,000.

CAPE GIRARDEAU, MO. — The Marquette Cement Manufacturing Company, 140 South Dearborn Street, Chicago, is considering extensions in the power plant at its local cement mill, to include the installation of a steam turbo-generator, waste-heat boilers, etc. F. S. Richards is plant superintendent.

KANSAS CITY, MO.—The Wabash Railroad Company, St. Louis, plans to install electric power equipment at its proposed car repair shops and yards at North Kansas City, to cost about $500,000.

ST. LOUIS, MO.—The Board of Estimates and Apportionment has approved an appropriation of $1,000,000 for the construction of a municipal substation. Power will be secured from the Union Electric Light & Power Company.

ST. LOUIS, MO. — Extensions and improvements involving an expenditure of about $11,000,000 are contemplated by the Union Electric Light & Power Company during 1925. The work will include expansion of its distribution system, including placing wires underground on 20 miles of streets during the next five years, laying six new cables on the bottom of the Mississippi River to connect the Cahokia plant with the St. Louis distribution system, enlargement of the Ashley Street plant, the erection of a 35-mile transmission line from Cahokia to Crystal City, converting the Lucas Avenue and the Charles Street substations to automatic substations, doubling the capacity of the Kingsbury Avenue substation, extensions to the distribution system in and around East St. Louis, remodeling office building, etc.

AVOCA, NEB.—The distribution system of the municipal electric system has been purchased by the Illinois Power & Light Corporation through its subsidiary, the Omaha & Lincoln Railway & Light Company. Service will be supplied from the distribution system of the company at Weeping Water, 4½ miles distant, by means of a 33,000-volt transmission line.

LINCOLN, NEB.—The Nebraska Gas & Electric Company has put into service a 66,000-volt transmission line extending from Lincoln to Plattsmouth, a distance of 57 miles. Through error an item was published in the issue of Jan. 17 stating that the company was planning to erect the line.

WINTHROP, MINN.—Plans are under way for the reconstruction of the municipal electric power plant, for which, it is expected bids will be asked early in the spring. Toltz, King & Day, Inc., Builders' Exchange, St. Paul, are engineers.

Southern States

CHADBOURN, N. C. — The electric plant of the Chadbourn Manufacturing Company is reported to have been acquired by the Tidewater Power Company, Wilmington, which, it is said, will erect a transmission line from Wilmington to Whiteville, and also extend the electric service from Chadbourn to Cerro Gordo and Fair Bluff.

GREENSBORO, N. C.—Plans are under consideration by the North Carolina Public Service Company to extend its lines to furnish electricity in the villages of Pleasant Garden, Summerfield, Stokesdale and Madison.

HIGH POINT, N. C.—The High Point Furniture Company is planning to purchase an engine-driven generator set of about 350 kw. and accessories for its power house.

SHELBY, N. C. — The Beaver Dam Power Company, recently organized, plans to erect a transmission line from Shelby to Beaver Dam to furnish electricity in that section. A. W. McMurray, Shelby, is president of the company.

OKEECHOBEE, FLA. — Extensions and improvements are contemplated to the local electric light and power system, recently acquired by the American Power & Light Company.

CRAB ORCHARD, TENN. — Plans for the proposed three-unit cement mill to be erected by the Southland Portland Cement Company, Volunteer Life Building, Chattanooga, include a power house. The cost of the project is estimated at $1,200,000.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has disposed of an issue of $495,000 in capital stock, part of the proceeds to be used for extensions in transmission system, etc.

CALERA, ALA.—The Alabama Lime & Stone Corporation, 1302-6 First Avenue, Birmingham, plans to install electric power equipment at its proposed local stone-crushing, lime-manufacturing and by-products plant, to cost about $500,000.

CLIO, ALA.—The Public Service Commission has granted the Pea River Power Company, Troy, permission to extend its transmission line from Brundidge to Clio and to install an electric distribution system here.

FLORENCE, ALA.—Bids will soon be asked by the United States District Engineer for a headgate-operating rig for auxiliary turbines.

FLORENCE, ALA. — Bids will be received at the office of the United States Engineer, Florence, until Jan. 28 for furnishing porcelain insulators with cable clamp for 15,000-volt service. For details see Searchlight Section.

FLORENCE, ALA—Bids will be received until Jan. 29 by the United States Engineer for a quantity of generator lead cable for the power house at the Wilson Dam, Tennessee River.

RED LEVEL, ALA.—The River Falls Power Company has been granted permission by the Public Service Commission to erect a transmission line from River Falls to Red Level.

BAY ST. LOUIS, MISS.—The electric plant of the Bay Ice, Light & Bottling Works has been acquired by the Mississippi Power Company, Gulfport.

GULF, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 17, for furnishing electric wiring materials, lumber, etc., at the quarantine station at Gulf. For details see Searchlight Department.

McKINNEY, TEX. — The Texas Power & Light Company, Dallas, is planning to extend its lines into the Free Methodist College Addition, a suburb of the city.

SAN ANTONIO, TEX. — The San Antonio Public Service Company is perfecting plans for extensions and improvements during 1925 to cost about $1,000,000.

Pacific and Mountain States

BELLINGHAM, WASH. — The Commissioners of Wickersham County have granted the Wickersham Light & Power Company a franchise to supply electricity in this district.

BELLINGHAM, WASH.—Plans for the proposed local beet-sugar mill to be erected by the Utah-Idaho Sugar Company, Salt Lake City, include a power house. The cost is estimated at $1,250,000. W. Y. Cannon is chief engineer.

OLYMPIA, WASH.—The Olympia Pulp & Paper Company has taken over the former plant of the Tumwater Brewing Company, which it proposes to remodel for its initial plant. The plans include the installation of electric power equipment.

SEDRO-WOOLLEY, WASH. — The construction of a 13,500-kva. substation in Sedro-Woolley, to cost about $300,000, is contemplated by the Puget Sound Power & Light Company, Seattle, during 1925. It will be a switching station for the Baker River power lines and a distributing station where secondary lines at 55,000 volts will branch out to Bellingham and other Puget Sound points.

TACOMA, WASH.—Application has been filed with the Supervisor of Hydraulics by L. J. Vogter, 3657 East R Street, asking permission to use 500 cu.ft. of water per second from the Dosewallips River, a tributary to Hood Canal on the Olympia Canal. The plans call for the construction of a 20,000-hp. plant, with a 50-ft. dam in Humpoff Canyon, 200 ft. long, and a 2-mile tunnel. The cost of the project is estimated at $2,000,000.

WENATCHEE, WASH. — The Puget Sound Light & Power Company, Seattle, is planning extensions in its local system, to cost about $200,000.

WINLOCK, WASH.—The Puget Sound Power & Light Company, Seattle, has purchased the electric distribution systems in Winlock, Castle Rock, Vader, Toledo and Napavine formerly owned by the Washington-Idaho Light & Power Company, recently sold by the receiver. The power plant was not taken over. The systems in each town will be improved and rebuilt.

BAKER, ORE. — The construction program of the Eastern Oregon Light & Power Company for 1925 includes a new fireproof building at the South Baker steam plant inclosing the turbine, where a new turbine was installed in 1923, and the rerouting of 17 miles of transmission line between Union and La Grande, more than doubling the capacity of the line.

SALEM, ORE. — In a message to the State Legislature Governor Pierce has recommended the construction of a state-owned hydro-electric power plant at Cedar Lake in Lane County, with steel-tower transmission line in the Willamette Valley district. The cost of the project is estimated at $1,000,000.

ALHAMBRA, CAL.—The City Council is planning for the installation of an improved lighting system on Vega Street. M. H. Irvine, city engineer, is in charge.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company has made application for permission to install two submarine cables under the entrance to the West Basin, Los Angeles Harbor.

LOS ANGELES, CAL. — The Board of County Supervisors is planning to install an ornamental lighting system on Brooklyn Avenue between Indiana and Record Streets, using reinforced-concrete standards.

OAKLAND, CAL.—The City Council has appropriated $150,000 for extensions and improvements in the street-lighting system, including ornamental and other lamps during 1925. Extension to the fire-alarm system in the West Oakland district is under consideration.

PASADENA, CAL. — Plans have been approved for the installation of an ornamental lighting system on Oakland Avenue between California and Green Streets. Reinforced-concrete standards are to be used.

SAN DIEGO, CAL.—The San Diego Electric Railway Company plans to install electric power equipment at its proposed repair and mechanical shops, to cost about $200,000. E. M. Hoffmann and G. A. Hanssen, Spreckels Building, are associated architects.

STOCKTON, CAL.—Plans are under way for the construction of a central fire-alarm and police-signal system station, to cost about $25,000.

BOISE, IDAHO. — The Gem Irrigation District has secured permission from the United States Reclamation Service to construct a hydro-electric plant at the Black Canyon dam, to cost about $450,000.

LEWISTON, IDAHO.—The City Council has engaged Stevens & Koon, Portland, Ore., engineers, to prepare preliminary plans for the proposed municipal hydro-electric power development on the Clearwater River, at Reuben Rapids. The plans provide for three units of 4,000 hp. each, to cost, with transmission system, about $2,092,000.

MALTA, MONT. — The Utah-Idaho Sugar Company, Salt Lake City, Utah, plans to build a power house at its proposed local beet-sugar mill. The cost of the project is estimated at $750,000.

Canada

VANCOUVER, B. C.—Plans are under consideration by the Canadian Pacific Railway Company for the electrification of its railroad from Revelstoke to Calgary, a distance of about 200 miles. Electricity to operate the road will be generated at Surprise Rapids in the Columbia River, north of Golden, about 18 miles from the main line of the railway.

NIPIGON, ONT.—Plans are being considered by the Hydro-Electric Power Commission of Ontario for diversion of the waters of Albany Lake into Nipigon Lake to increase the water supply for plants at Cameron Falls, to cost about $1,000,000. F. A. Gaby is chief engineer of the commission.

TORONTO, ONT.—Extensions and improvements are under consideration by the Bell Telephone Company to its local system, to cost about $750,000. The work will include new conduits, underground cables, etc., and new exchanges on Asquith Street and Runnymede Road.

Electrical Patents

Announced by U. S. Patent Office

(Issued December 30, 1924)

1,521,241. ELECTRICAL INSULATING MEDIUM; Willis W. Hale, Cleveland, Ohio. App. filed June 3, 1920. Good conductor of heat.

1,521,251. INCANDESCENT-LAMP LOCK; Max Rachlin, New York, N. Y. App. filed March 9, 1922.

1,521,252. TRANSFORMER; Einar N. A. Rauland, Chicago, Ill. App. filed July 1, 1922. Adapted for use in radio telegraphy and telephony.

1,521,273. INTERLOCKING RELAY; Stanley C. Bryant, Chicago, Ill. App. filed Aug. 27, 1920. For highway-crossing signals and other railway-signaling systems.

1,521,280. ROTARY CONVERTER; Rene de Bruyn, Mont-sur-Marchienne, Belgium. App. filed Feb. 24, 1921. Variable voltage.

1,521,295. DRY CELL; Homer D. Holler, Leonia, N. J. App. filed May 12, 1921.

1,521,301. DYNAMO-ELECTRIC MACHINE; Thomas S. Jones, Newport, England. App. filed June 14, 1922. With cylindrical armature working in conjunction with exterior and interior pole or winding systems, means being provided for varying and adjusting the relative positions of the systems.

1,521,359. MOTOR DRIVE; Louis J. Costa, Philadelphia, Pa. App. filed March 1, 1924. Through gearing.

1,521,361. ARC LAMP; Arthur P. Davis, Brooklyn, N. Y. App. filed Dec. 31, 1917. Flaming-arc type.

1,521,372. WINDING MACHINE; Bernard F. Johnson, Jersey City, N. J. App. filed May 22, 1923. For winding copper wire into coils or helices for use in electrical apparatus.

1,521,396. WINDING MACHINE; Archibald D. Scott (deceased) by Mary V. Scott, executrix, Jersey City, N. J. App. filed July 14, 1923. For winding strands of material as wire, into coils, helices or bobbins, for use in electrical apparatus.

1,521,402. CONTROL MECHANISM FOR ELECTRIC FURNACES; Barton R. Shover, Pittsburgh, Pa. App. filed Feb. 15, 1921.

1,521,411. EQUALIZING DEVICE FOR COMPRESSION RESISTORS; Gustav O. Wilms, Milwaukee, Wis. App. filed June 16, 1922. Means for applying equal pressures to a multiplicity of current-controlling devices of compression-resistor type.

1,521,432. ELECTRICAL SWITCH; John F. Cavanagh, Providence, R. I. App. filed April 24, 1924. Toggle type.

1,521,433. INDICATING INSULATOR; Robert W. Charlton, Pineville, La. App. filed April 17, 1923. For open wiring; body portion and cap provided with groove or duct that registers.

1,521,441. RECTIFIER; John W. Fraser, Cleveland, Ohio. App. filed April 23, 1923. For charging radio-plate batteries.

1,521,488. TWO-WAY SWITCH; Walter Van Guilder, Chicago, Ill. App. filed Sept. 29, 1922.

1,521,500. FILM CASE; Oskar Becker, Berlin-Treptow, and Gerhard Ollendorff, Berlin-Wilmersdorf, Germany. App. filed Feb. 7, 1924. As used in X-ray photography.

1,521,530. ELECTRIC SWITCH; Oscar Hammerstrom, Bridgeport, Conn. App. filed April 28, 1924. One-way rotary snap switch.

1,521,534. ANNUNCIATOR DROP; Charles Herrmann, Brooklyn, N. Y. App. filed Feb. 16, 1921.

1,521,553. PLASTER SHIELD FOR INCLOSED SWITCHES; Benjamin E. Getchell, Plainville, Conn. App. filed Oct. 14, 1922. Controlling house-lighting circuits.

1,521,584. BATTERY CHARGING AND DISCHARGING SYSTEM; Henry R. Davies, Toledo, Ohio. App. filed April 8, 1919. Automatic.

1,521,586. MEANS FOR REGULATING THE VOLTAGE OF DISTRIBUTION SYSTEMS; Frank W. Merrill, East Orange, N. J. App. filed May 17, 1921. Automatic; comprising a variable-impedance device.

(Issued January 6, 1925)

15,974 (reissue). PROTECTIVE DEVICE FOR ELECTRIC FLATIRONS; W. T. Hoofnagle, Glen Ridge, N. J. App. filed Feb. 10, 1921. Fuse.

1,521,591. ELECTROMAGNETIC DEVICE; W. O. Beck, Ridgefield, N. J. App. filed June 20, 1921. Relay for telephone and signaling circuits.

1,521,592. ELECTROPLATING APPARATUS; W. E. Belke, Chicago, Ill. App. filed Oct. 29, 1923. Supports for the articles to be plated.

1,521,605. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; F. Diehl, Elizabeth, N. J. App. filed Dec. 12, 1923. Of the box type used on fractional-horsepower motors.

1,521,608. TELEPHONE SYSTEM; G. R. Eaton, Oak Park, Ill. App. filed March 30, 1922. In which link circuits are provided for interconnecting telephone lines.

1,521,654. CONTROLLER FOR ROTARY CONVERTERS; E. W. Seeger, Milwaukee, Wis. App. filed Jan. 31, 1921. For starting from the alternating-current side.

1,521,664. TESTING CIRCUITS FOR ECHO SUPRESSORS; S. B. Wright, East Orange, N. J. App. filed Oct. 25, 1923. For long telephone circuits.

1,521,671. CARRIER-TELEGRAPH CIRCUITS; R. W. Deardorff, Brooklyn, N. Y. App. filed Oct. 21, 1920.

1,521,674. CARRIER-TELEGRAPH CIRCUITS; L. Espenschied, Queens, N. Y. App. filed Oct. 21, 1920.

1,521,685. CARRIER-TELEGRAPH CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Oct. 21, 1920.

1,521,726. ART OF PREPARING WOOD SEPARATORS FOR STORAGE BATTERIES; P. A. G. Steerup, Chicago, Ill. App. filed Jan. 11, 1918.

1,521,728. TRUNK CIRCUIT; W. B. Strickler, East Orange, N. J. App. filed Aug. 7, 1920. For telephone system.

1,521,743. INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Dec. 6, 1920. High-voltage.

1,521,744. COMMUTATOR BRUSH; R. N. Baylis, Caldwell, N. J. App. filed June 24, 1924. Reaction type.

1,521,748. HANDLE FOR ELECTRIC IRONS; H. I. Brey, Brookville, Pa. App. filed March 21, 1923.

1,521,755. TRANSMISSION SYSTEM; R. D. Conway, Chatham, N. J. App. filed March 29, 1920. Telephone system.

1,521,766. ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed July 2, 1923. Wattmeters.

1,521,771. TELEPHONE-EXCHANGE SYSTEM; H. L. Hoffman, New York, N. Y. App. filed April 3, 1920. Automatic.

1,521,777. RADIO SYSTEM; D. G. McCaa, Lancaster, Pa. App. filed July 18, 1923. Receiving apparatus.

1,521,793. ALARM DEVICE; W. C. Roe, New York, N. Y. App. filed July 31, 1922. Burglar-alarm system.

1,521,821. REPEATER FOR AUTOMATIC TELEPHONE SYSTEMS; C. E. Lomax and R. F. Stehlik, Chicago, Ill. App. filed Oct. 22, 1923.

1,521,824. REGULATOR; F. W. Merrill, East Orange, N. J. App. filed May 17, 1921. To vary automatically the characteristics of an electrical circuit proportionate to the difference in speed of two rotating bodies.

1,521,841. INCLOSED EXTERNALLY OPERATED TIME SWITCH; R. D. Smith, Yonkers, N. Y. App. filed May 8, 1918.

1,521,852. AMPLIFIER CIRCUITS; H. D. Arnold, Maplewood, N. J. App. filed July 11, 1919.

1,521,870. TELEGRAPH SYSTEM; A. A. Clokey, Rutherford, N. J. App. filed Dec. 1, 1921. With synchronously operated means for relaying or repeating signal-current impulses from one circuit to another.

1,521,894. METHOD OF AND MEANS FOR ELECTRIC ARC WELDING; J. C. Lincoln, Cleveland, Ohio. App. filed Jan. 26, 1920.

1,521,901. CIGAR LIGHTER; L. H. Morrill, Saginaw, Mich. App. filed Jan. 9, 1922.

1,521,903. CONNECTION CLIP; R. S. Mueller, Cleveland Heights, Ohio. App. filed April 25, 1921.

1,522,006. TESTING SYSTEM; H. Fletcher, New York, N. Y. App. filed Nov. 20, 1922. For telephone transmission line.

1,522,022. PLUG PIN; E. Meier, Christiania, Norway. App. filed Jan. 3, 1924. Two-pin plug for wall sockets.

1,522,027. DYNAMO-ELECTRIC MACHINE; C. A. Parsons and J. Rosen, Newcastle-upon-Tyne, England. App. filed May 12, 1923. Cooling of.

1,522,044. SECRET COMMUNICATION SYSTEM; R. Bown, East Orange, N. J. App. filed Nov. 8, 1921.

1,522,070. MEANS FOR TRANSFORMING LIGHT IMPULSES INTO ELECTRIC CURRENT IMPULSES; T. H. Nakken, Rotterdam, Netherlands. App. filed Nov. 3, 1920.

1,522,100. SPIRIT-LEVEL ILLUMINATING DEVICE; E. Bright, Fort des Moines, Iowa. App. filed May 8, 1923.

1,522,101. PLUGGING BOX; E. G. Bruegeman, Los Angeles, Cal. App. filed Nov. 29, 1920. For portable apparatus such as is used on theatrical stages, etc.

Financial and Corporate

Stocks Are Irregular

Market Reveals Mixture of Gains and Losses in Generally Quiet Week

PERIODIC spells of advances and recessions such as characterized trading on the big board during the week ended January 17 were evident also in the unlisted market for power and light stocks. Of late the unlisted markets have, indeed, seemed to move somewhat in sympathy with the other markets. Perhaps it is because the same influences are at work in both cases. That is, while public buying of stocks remains good, a substantial amount of profit taking also is taking place.

On the failure of the House to take any immediate stand on the Underwood Muscle Shoals bill several stocks, particularly Southeastern Power & Light and Tennessee Electric Power, turned to positions poorer by several points than the levels previously occupied. These stocks seem to rise or fall several points, however, according to whether the news is favorable or unfavorable. Commonwealth Power Corporation on going ex-dividend lost ground, dropping to 117¼ the day before, or to the equivalent of that price less 1¼ points, but afterward soon ran up to better than 125. Only fractional changes for the week were recorded by such market leaders as American Power & Light and American Gas & Electric. United Gas & Electric, on the other hand, lost three points, and Northern Ontario Light & Power improved its position by two points.

The announcement of the reorganization plan for the Northern Ohio Electric Corporation has brought a somewhat better market in the old issues, although trading in them during the last few days has pretty much subsided. The old preferred has been dealt in at levels close to 25. While no real market has as yet been created in the new Northern Ohio Power Company stock, sales of the stock on a "when issued" basis have been reported between 5 and 10.

American Gas & Electric Company to Get New Property

Through consolidation with the Appalachian Securities Corporation the American Gas & Electric Company is negotiating for the Virginia Power Company, operating directly and through subsidiaries in Ohio and West Virginia. A special meeting of the stockholders has been called for February 17 to consider this consolidation. The Appalachian Securities Corporation or a subsidiary will acquire the property and assets of the Virginia Power Company by issuing 82,000 shares of Appalachian Securities first preferred stock. The stockholders of the Virginia Power Company will vote February 4 on this contract. The Appalachian Securities Corporation has issued its first preferred stock and preferred and common stocks share for share for the first preferred, preferred and common stock of the Appalachian Power Company. The Securities Corporation at the present time owns more than 53,000 shares of the entire capital stock of the Power Company, including more than 48 per cent of the common.

The consolidated company will have an authorized capital of 600,000 shares of cumulative preferred and 2,250,000 shares of common, all of no par value. The agreement provides for the exchange of two shares of the preferred stock of the American Gas & Electric, par value $50, for one share of the consolidated company's preferred, and one share of common of the old company for one share of the new company. For each share of Appalachian Securities first preferred the merger company plans to issue one and two-ninths shares of preferred stock; for each share of second preferred one and one-half shares, and for each share of common one share of preferred, entitled to dividends from January 1, 1927, or at the option of the stockholder, nine-tenths of a share of preferred stock entitled to dividends from February 1, 1925.

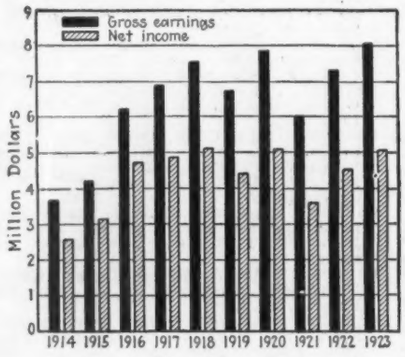
Montana Power Company's Situation

This Important Hydro-Electric Development Serves Seventy Cities and Towns but Also Does a Substantial Wholesale Power Business

BY PAUL WILLARD GARRETT

THE Montana Power Company was incorporated only about twelve years ago, in December, 1912, as a consolidation of several power and light companies that had been operating in Montana. The five originally consolidated were the Butte Electric & Power Company, Madison River Power Company, Billings & Eastern Montana Power Company, Missouri River Electric & Power Company and the old Montana Power Company.

One of the advantages that have resulted from the consolidation has been the better development of generating and distributing facilities. The abundance of available water power has made it possible for the company to produce energy at a relatively low cost at its hydro-electric plants, of which now there are fourteen altogether. These plants, incidentally, all feed into the main system, thus making the whole system a connected unit.



GROSS EARNINGS OF MONTANA POWER COMPANY COVERING TEN-YEAR PERIOD

In the course of the last twelve years or so the Montana Power Company has extended its service until now it provides electric light and power for a territory that extends from the western line of the State of Montana to Billings, a distance of 459 miles east and west, and from Havre, near the Canadian border, to the Yellowstone National Park. The territory embraces the principal agricultural, timber and mining sections of the state, including virtually all of the important cities and towns in one of the largest states territorially in the Union. It operates in such places as Anaconda, Butte, Billings, Boulder, Hot Springs, Great Falls, Livingston, Harlowton and Helena. While the territory is large, the state does not, of course, include so very many large industrial centers.

Investors who conclude, however, that the Montana Power Company is dependent for its business entirely upon the seventy cities and towns to which it sells light at retail miss one of the most important sources of the company's revenue. It has a number of large contracts under which it sells power at wholesale to large corporate enterprises, the outstanding contracts among these being perhaps the one with the Anaconda Copper Company and that with the Chicago, Milwaukee & St. Paul. About 430 miles of the latter's main transcontinental line is electrified, so that the revenue from that source alone is substantial.

The Montana Power Company's corporate structure is relatively simple. The company is capitalized at $94,006,600, of which $34,588,700 is in bonds and $59,417,900 in stocks, a much more conservative apportionment than can be claimed for many companies. Indeed, the bonds and preferred stock together make up less than half of the company's capitalization, and therefore all issues senior to the common stock occupy a pretty favorable investment position.

It is a tribute to the company's sound

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.

Companies	Bid Price Saturday, Jan. 17	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	a 99	94	99
Appalachian Power, 7 per cent	a 96	85½	93
Arkansas Light & Power 7 per cent	a 93	81	96
Asheville Power & Light 7 per cent	a 99	97	100
Central Illinois Public Service 6 per cent	a 85	84	88
Colorado Power 7 per cent	a 92	90	98
Connecticut Light & Power 7 per cent	a106	99	106
Consumers' Power 6 per cent	a 91	85	93
Dayton Power & Light 6 per cent	a 90	84	101
Duquesne Light 7 per cent	a105½	102	108½
Eastern Texas Electric 6 per cent	a 99	81	105
Empire District Electric 6 per cent	a 78	70	78
Fort Worth Power & Light 7 per cent	a101	98	103
Great Western Power 7 per cent	a 97	96	99
Illinois Northern Utilities 6 per cent	a 86½	82	87
Illinois Power & Light 7 per cent	a 90	84	95
Kansas Gas & Electric 7 per cent	a 98	95	98
Long Island Lighting 7 per cent	a103	95½	102
Minnesota Power & Light 7 per cent	a 96	96	98
Mississippi River Power 6 per cent	a 88	80	90
Nebraska Power 7 per cent	a 98	95	99
Niagara, Lockport & Ont. Power 7 per cent	a104	99	107
Northern States Power 7 per cent	a 95½	91	97
Ohio Public Service 7 per cent	a 98	86	100
Pacific Gas & Electric 6 per cent	a 94	85	94
Penn-Ohio Power & Light 7 per cent	91	84	96½
Pennsylvania Power & Light $7—no par	a101	97	100
Penn. Public Service 7 per cent	a 90	90	100
‡Philadelphia Electric 8 per cent—25	a 41½	29½	40
Southern California Edison 8 per cent	a115	112	120
Tennessee Electric Power, 6 per cent	a 73	47	73½
Texas Power & Light 7 per cent	a100	97	100
Utah Power & Light 7 per cent	a 98	96	99
Western States Gas & Electric 7 per cent	a 83	78	86
Yadkin River Power, 7 per cent	a 99	97	100
Holding Companies			
American Gas & Electric 6 per cent—50	a 45½	41½	46
American Light & Traction	a 94	91	94½
American Power & Light 6 per cent	a 88	84	91
American Public Service 7 per cent	a 90	84	95
American Public Utilities 7 per cent	a 88	73	88
American Water Works & Electric 7 per cent	a101½	89½	101
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 49	42	52
Carolina Power & Light 7 per cent	a100	95½	101
Central Indiana Power 7 per cent	a 88	80	93
Cities Service 6 per cent	a 80½	67	83
Commonwealth Power 6 per cent	a 80½	72	82½
Consolidated Gas 6 per cent—50	a 67½	51	59½
Continental Gas & Electric 7 per cent pr. pf.	a 90	69	93
Electric Bond & Share 6 per cent	a102	96½	104
General Gas & Electric—$8—no par	a105	96	105
*Middle West Utilities 7 per cent	a 92½	80	94
National Power & Light—$7—no par	a 96	84	96½
North American 6 per cent—50	a 46½	43½	50½
Northern Ohio Electric	a 25	16	34
Public Service Corp. of N. J. 7 per cent	a101	96½	101½
Public Service Corp. of N. J. 8 per cent	a110½	99½	115
§tandard Gas & Electric 8 per cent—50	50	46½	50
†United Gas Improvement—50	57½	55½	58
United Light & Power—$6.50—no par	83	75½	84
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	a 34	22½	37
Appalachian Power—no par	a 76	66	93
Arkansas Light & Power	a 60	22	63
Brooklyn Edison	a127½	107½	124½
Buffalo General Electric	a 44 (new)	118(old)	190(old)
Colorado Power	a 33	21	35
*Commonwealth Edison	a135½	126	136½
§Consolidated Gas, Electric Light & Power	a 33½	32½	37½
Dayton Power & Light	a185	70	180
Detroit Edison	a113½	102½	115½
|| Edison Electric Illuminating of Boston	a200½	163½	201
Long Island Lighting	200	100	200
Mississippi River Power	a 37½	18	35
Montana Power	a 68½	61½	74½
Niagara, Lockport & Ontario Power—no par	a 64	42	54
Northern Ohio Electric—no par	a 3	5	16
Northern States Power	a105	92	106
North Texas Electric	a 65	58	84
Pacific Gas & Electric	a103½	90½	105
‡Penn Central Light & Power—no par	61	57	60½
§Pennsylvania Water & Power	a127½	98½	135½
‡Philadelphia Electric—25	a 42	29	40½
*Public Service Co. of Northern Illinois	a108½	99	111½
Puget Sound Power & Light	a 54	43½	61½
Southern California Edison	a101	95	106
Tampa Electric	a172	134	170
Tennessee Electric Power—no par	a 53	20	51
Virginia Power	a 80	16	70
Virginia Railway & Power	a 66½	36	72½
West Penn. Co.	a114½	47½	121

Companies	Bid Price Saturday, Jan. 17	Low 1924	High 1924
Holding Companies			
‡American Electric Power—50	61	22½	62½
American Gas & Electric—no par	a 75	43½	115
American Light & Traction	a140	115	148
American Power & Light	a 61½	34½	68
American Public Utilities	a 75	35	97
American Water Works & Electric	a 37½	24	41½
Carolina Power & Light—no par	320	82½	330
Cities Service	a178½	140	187
Columbia Gas & Electric—no par	a 46½	33	48
Commonwealth Power Corp.—no par	a122	56	130
Consolidated Gas—no par	a 76½	60½	79½
Continental Gas & Electric	a 87	49	96
Federal Light and Traction	136½	75	122½
General Gas & Electric	a 79	22	75
Lehigh Power Securities—no par	a111	31	110
*Middle West Utilities—no par	a 85	41	88½
National Power & Light—no par	a211	60	247
North American—10	a 43½	22	45
Philadelphia Co.—50	a 55½	42½	57½
Power Securities—no par	a 16	4	18
Public Service Corp. of N. J.—no par	a 69½	39	70
Standard Gas & Electric—no par	a 43½	31½	41½
United Gas & Electric (Conn.)—no par	a 32	14	42
Utah Securities	a 51½	16½	46
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	a102½	97½	103
Alabama Power 5s 1946	a 96½	90½	97
Appalachian Power 5s 1941	a 96½	89	96
Brooklyn Edison 5s 1949	a 99½	97½	102½
6s 1930	a104½	102½	107
7s 1940	107½	107	110½
Cleveland Electric Illuminating 5s 1939	a100½	98½	101
Commonwealth Edison 5s 1943	a100	95	101
5s 1953	a 98½	92	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	a 95½	91	96
6s 1949	105	102½	106
Consumers' Power 5s 1936	a 99	94½	99½
5s 1952	a 92½	87	92½
Detroit Edison 5s 1933	a100½	99	101½
Duquesne Light 6s 1949	a107	103½	106½
Great Western Power 5s 1946	95½	90½	96
Kansas City Power & Light 5s 1952	a 96½	89	96½
Mississippi River Power 5s 1951	a 96½	92	97½
Montana Power 5s 1943	a 99½	95	99
New England Power 5s 1951	101	97	101½
New York Edison 6½s 1941	a113½	109½	114½
Niagara Falls Power 6s 1950	a106	104	106
Northern States Power 5s 1941	a 94½	89½	94½
6s 1941	105½	101	105
Ohio Power 7s 1951	a106½	103	107
Pacific Gas & Electric 5s 1942	a 94½	90½	95
Pennsylvania Water & Power 5s 1940	a100	96	100
‡Philadelphia Electric 5s 1966	a100½	97	103½
6s 1941	a106½	103½	107½
Portland Electric Power 6s 1947	a 95½	89½	97
Southern California Edison 5s 1939	a 99½	96	100
6s 1944	a 92½	100	103½
Tennessee Electric Power 6s 1947	a100	93½	99½
Texas Power & Light 5s 1937	96½	91½	97
Toledo Edison 7s 1941	a109	106	110
Utah Power & Light 5s 1944	a 92½	87½	93½
Holding Companies			
Alabama Traction, Light & Power 5s 1962	a 86	65½	86
American Gas & Electric 6s 2014	a 96	94	95½
American Power & Light 6s 2016	a 94½	91	94½
Amer. Water Works & Electric 5s 1934	a 93½	84½	94
Associated Gas & Electric 6½s 1954	a 99½	92½	94½
Central Indiana Power 6s 1947	a 96	88	96½
Commonwealth Power 6s 1947	a 99½	87	98
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	a 75½	64	76½
Illinois Power & Light 6s 1953	a100	95	101
United Light & Railways 5s 1932	94½	87½	94½
6s 1952	97	92	97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	a107	90	104½
*National Carbon	124	112	125
Worthington Pump & Machinery	85½	68	89½
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 80½	41½	73½
American Bosch Magneto—no par	a 43	22½	38½
Electric Storage Battery—no par	a 65	50½	66
General Electric	a311	193½	301
General Electric—10	a 11½	10½	11½
*Hurley Machine—no par	a 52½	48	66
†Wagner Electric	32	20	34½
Westinghouse Electric & Manufacturing—50	a 76½	55½	71½
Worthington Pump & Machinery	a 68½	23½	80½
BONDS			
Canadian General Electric 6s 1942	a107½	102½	107½
General Electric 3½s 1942	84	80	84½
5s 1952	a103½	100	105½
Robbins & Myers 7s 1952	67	65	91½
†Wagner Electric Manufacturing 7s	101½	97	101
Western Electric 5s 1944	a 98½	96	99½
Westinghouse Electric & Mfg. 7s 1931	a108	106½	109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Wednesday, January 21.

structure and good management that, despite the severe agricultural and mining depression that Montana has suffered in recent years, interest and dividend payments have always been maintained. Even the common stock has received cash dividends in every year since the company was organized. Fixed charges and preferred dividend requirements always have been earned by wide margins. In 1923, for example, interest charges were earned 2.70 times, and after meeting fixed charges the company showed 31.35 per cent available for its 7 per cent cumulative preferred stock.

As its territory develops more and more Montana Power Company should be able to increase its earning power at an accelerating rate. It has large undeveloped water-power reserves.

N. J. Public Service Forms New Investment Company

Articles were filed last week with the Secretary of State at Trenton incorporating the Public Service Stock & Bond Company, organized to do a general business in investment securities, specializing in the securities of the Public Service Corporation of New Jersey and its subsidiaries. The issuance of 500,000 shares of stock of no par value was authorized, the entire block of which with the exception of the directors' qualifying shares will be owned by the Public Service Corporation.

The incorporators were Thomas N. McCarter, president of the Public Service Corporation, and E. W. Wakelee and Percy S. Young, vice-presidents. In a statement concerning the new company Mr. Young said: "The success of our various customer-ownership campaigns has given us a total of more than 70,000 stockholders and subscribers to stock. Adding bondholders and those who own the securities of underlying companies, there are more than 120,000 financially interested in various Public Service enterprises. It is to assist in every possible way these investors and to increase their number further that the new company has been formed."

Habirshaw Electric & Cable Reorganization Plans

Reorganization of the Habirshaw Electric & Cable Company and its subsidiary companies is approaching completion as a result of the progress made recently by the two banking committees representing about 80 per cent of the creditors' claims. The committees include the Whitman committee, representing the Central Union Trust Company, and the Potter committee, representing the Guaranty Trust Company.

The reorganization plan provides for the formation of a new company with a capital consisting of 170,000 shares of stock, 20,000 of which will be sold for $300,000 cash and the remaining 150,000 distributed among creditors holding claims aggregating $5,700,000. The stock of the new company will be placed under a voting-trust agreement. There will be three trustees, one appointed by the Whitman committee, one by the Potter committee and one by W. A. Harriman & Company, Inc. The Harriman company will take over the 20,000 shares of stock previously referred to. George H. Walker of the Harriman firm will be chairman of the new company, and the management, operating at present under John S. Worley as receiver, will be continued. The courts had not approved these plans up to the time the ELECTRICAL WORLD went to press. It is believed that an effort will be made to get a decision on Saturday, January 24.

New Capital Issues

During the past week the Cities Service Company floated an issue of 7 per cent convertible gold debentures to the amount of $2,500,000, at a price of 99¼ and accrued interest, to yield over 7 per cent. These series D debentures are a direct obligation of the company and bring the total of all series outstanding in the hands of the public to $26,680,515. The Community Power & Light Company, which last week was represented by a million-dollar stock issue, contributed $2,250,000 to this week's total in the form of first mortgage collateral sinking-fund gold bonds dated January 1, 1925, and maturing January 1, 1950. The proceeds will be used to finance in part the acquisition from the North America Company of a group of valuable properties in southeast Missouri and also to finance the construction of substantial transmission line extensions in Kansas, Missouri and Arkansas. With the purpose of retiring some of its floating debt, the El Paso Electric Company, a Stone & Webster property, issued 7 per cent cumulative preferred stock totaling $1,500,000 at 103 to yield 6.80 per cent. The Ohio Public Service Company was also represented with an offering of 7 per cent cumulative preferred stock to the amount of $3,000,000.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
Commonwealth Power, com.	$1.50	Feb. 2
Commonwealth Power, pf.	$1.50	Feb. 2
Dallas Power & Light, pf.	1¾	Feb. 1
Electric Bond & Share, pf.	1¾	Feb. 2
Georgia Railway & Electric, pf.	1½	Jan. 20
Knoxville Power & Light, pf.	$1.75	Feb. 1
National Power & Light	$1.50	Mar. 2
No. New York Utilities, Inc., pf.	1¾	Feb. 1
Pacific Power & Light, pf.	1¾	Feb. 2
Power Corporation of New York, pf.	1¾	Feb. 1
Railway, Light & Securities, com*	$1	Feb. 2
Railway, Light & Securities, com.	$3	Feb. 2
Railway, Light & Securities, pf.	$3	Feb. 2
Texas Power & Light, pf.	1¾	Feb. 1
Fairbanks, Morse & Co., com.	65c.	Mar. 31
Fairbanks, Morse & Co., pf.	1¾	Mar. 2

* Extra

Annual Report of Detroit Edison Company

The soundness of the Detroit Edison Company's phenomenal growth is reflected in the 1924 annual report, just issued by President Alex Dow. Gross revenue increased 7.6 per cent, to $34,163,286, from $31,724,184, while earnings available for interest charges increased 9.6 per cent, to $10,265,562. from $9,359,726. Total output mounted to 1,460,631,400 kw.-hr., as against 1,360,017,300 kw.-hr. the previous year. Reduction in the operating ratio, which was brought down to 59.6 per cent from 61 per cent in 1923, contributed largely to the substantial increase in net income reported. Maintenance expenditures of $2,466,909 were ample to keep the property in first-class operating condition and were substantially larger than the 1923 figure of $2,155,108. Net increase in the fixed-plant account during the year was $24,825,918 after deducting all equipment retired from service, this being the largest addition made in the history of the company. The capital stock was increased from $43,405,900 to $61,148,100 by a new issue of $11,151,300 and by the conversion of $5,916,200 of debentures. Mortgage bonds outstanding were increased by the sale of $12,500,000 of 5 per cent general and refunding bonds under a new open-end mortgage.

"The reductions and adjustments of rates effective on January 1, 1924, and certain further reductions and adjustments made as of July 1," says Mr. Dow, "have served to restore our general rates to the figures, virtually, at which they stood before the war."

Company Reports

Among the company reports issued during the past week for the month of December are the following:

Name of Company	Gross Revenues for December 1924	1923
American Power & Light*	$3,156,700	$3,045,954
Appalachian Power	329,422	293,189
Associated Gas & Electric*	594,162	306,791
Detroit Edison	3,469,972	3,225,679
Manila Electric	326,220	317,571
Niagara, Lockport & Ontario Power	586,742	509,637

* November

Stockholders Approve Exchange.—The stockholders of the Eastern New Jersey Power Company approved an amendment to the certificate of incorporation providing for the issuance by the company of 8 per cent cumulative shares in exchange for the existing 7 per cent cumulative participating shares now outstanding. More than 80 per cent of the outstanding preferred stock consented to the change, which was also approved by the Public Utilities Commission.

New Electric Bond & Share Organization.—The company recently organized to take over the holdings of the General Electric Company in the Electric Bond & Share Company, discussed at length in a recent number of the ELECTRICAL WORLD, will be known as the Electric Bond & Share Securities Corporation.

Authorization by California Commission.—During 1924 the California Railroad Commission authorized the issuance by public utilities of stocks, bonds, notes and other forms of indebtedness amounting to $237,875,847 as compared with $196,802,935 in 1923. Of that total 89 per cent was for additions, extensions, betterments and new construction.